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PUBLIC HEALTH SERVICE

# LIGHTING FOR HOSPITAL PATIENT ROOMS

A report of a joint project by  
Public Health Service staff  
with consultants

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE  
Public Health Service  
Division of Hospital and Medical Facilities  
Architectural and Engineering Branch  
Washington 25, D.C.

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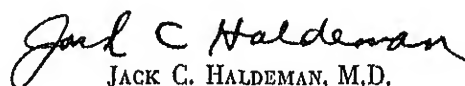
## FOREWORD

The provision of optimum lighting conditions in patient rooms is an important element in the design of hospital and related medical facilities. In determining lighting requirements, consideration should be given not only to the patient's personal needs and comfort but also to activities which take place in the patient's room, such as nursing care, medical examinations, test procedures, and housekeeping.

When this Hill-Burton Program activity was undertaken in 1956, the primary aims were to determine lighting requirements and to develop lighting levels that might serve as criteria for illumination of patient rooms. As the study progressed, the need was recognized for enlarging the scope of the project to include a study on how the lighting requisites might be met most economically and satisfactorily for both the patient and the hospital staff. Consequently, continuation of the project was authorized on this basis; the studies are referred to as Part I and Part II.

The recommendations in this report are based on an evaluation of the many problems concerning artificial illumination in patient rooms in general hospitals. The many factors which increase or lessen the reflectance or brightness of light—such as wall color and luminaire design—are discussed in some detail.

It is hoped that the findings of these studies will be useful as guidelines for architects, engineers, and others concerned with the design of lighting systems for hospital patient rooms.



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# SUMMARY

This report of lighting studies undertaken by the Public Health Service with the assistance of special consultants provides data and guidelines to aid hospital planners in determining the optimum lighting needs for a patient's room in a general hospital. Recommendations are also made as to how these requirements might best be met.

Most lighting studies in patient rooms heretofore have been chiefly confined to the problems relating to the patient's use of light during reading and resting. These studies, therefore, were designed to be more extensive in scope. In addition to setting forth ways to meet the various types of lighting required by patients, attention was given other essential considerations such as:

- (1) Optimum lighting conditions in the patient's room for hospital personnel (i.e., physician, nurse, and housekeeper) performing specific functions requiring different levels of illumination.

- (2) The effect of certain factors, such as the shape and positioning of lighting units and reflectances resulting from the color and type of walls, ceilings, bedclothes, and furnishings.

The team of investigators conducted its studies in specially designed mock-up patient rooms and in several multibed patient rooms in hospitals. All persons concerned, including not only the patient but also members of the hospital staff performing various tasks in the room, were consulted as to their lighting needs and preferences. In the mock-up rooms, many types of commercially available luminaires and experimental units were installed. Detailed studies were made by varying illumination levels and brightnesses as well as colors and reflectances of interior finishes. Photometer readings were taken and each situation was assessed to determine optimum lighting levels.

The importance of a close working relationship between the architect, interior decorator, and lighting engineer is borne out by tests and studies made to determine the extent to which lighting conditions are affected by color. Their joint efforts are essential since good lighting design must take into account not only the placement, shape, and type of luminaires to be used but also the brightness and reflectance values of the surface finishes and the color of ceilings, walls, floors, and furnishings.

The reflectance factors of any color selected by the architect or interior decorator should be shown on the architectural plans or in the specifications. By indicating the color and reflectance values of room interiors, an effective lighting system can be developed that takes into account the control of brightness and glare to provide visual comfort and to lessen ocular fatigue. During subsequent redecoration of room interiors, room finishes should be selected which will provide optimum lighting levels.

An important outgrowth of these studies has been the development of a tentative code of lighting levels and brightnesses. Criteria for the use of these data, presented in the advisory recommendations, are briefly stated as follows:

- General lighting should be indirect or designed so that the brightness of a luminaire or interior finish, when viewed from any normal in-bed position, does not disturb patients. The luminaire should be installed in such a manner that excessive spottiness of the lighting in the room will be minimized. The brightness thus produced should not exceed 90 foot-lamberts. Control equipment for dimming the lights may be used advantageously. Fluorescent lamps, if used in patient rooms, should be the deluxe (warm or cool white) type.

• Reading lights should provide a reasonable degree of uniformity of lighting over a reading plane of approximately 3 square feet for an adjustable-type unit and approximately 6 square feet for a nonadjustable-type unit.

• Local lighting should be provided or installed where needed for observation of specific conditions and should be positioned to light the bed area and equipment as necessary. As this light may remain on all night, a screen or some other provision should be made to shield the light from other patients.

• Examination lights should be of a type or so arranged to minimize shadows at the area of interest. Such lights should be shielded or adjusted to confine the illumination to the bed area of the patient being examined or treated, thus minimizing glare for others in the room. Illumination requirements for examinations and nursing service vary. For flexibility, controls may be provided for dimming the lights as necessary, depending on the frequency of use of these lights. Some types of luminaires lend themselves to dual use as examination lights and reading lights, but in most instances, it is impractical to combine these lighting features in a single luminaire.

• Nightlights should provide a low level of illumination with a low brightness-contrast value to minimize discomfort to patients but sufficient for the nurse to enter the room. A control switch mounted at the door may be provided for the nurse to switch the nightlight to a higher lighting level, if needed.

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## Definitions

### *Brightness—Photometric brightness (luminance), (B)*

The luminous flux per unit of projected area per unit solid angle either leaving a surface at a given point in a given direction or arriving at a given point from a given direction; the luminous intensity of a surface in a given direction per unit of projected area of the surface as viewed from that direction. (Note: Measured in foot-lamberts, as defined below.)

### *Color temperature of a light source*

The temperature at which a black-body radiator must be operated to have a chromaticity equal to that of the light source. (Note: Measured in degrees Kelvin.)

### *Footlambert (fL)*

Unit of photometric brightness (luminance) equal to  $1/\pi$  (pi) candle per square foot. A theoretical perfectly diffusing surface emitting or reflecting flux at the rate of one lumen per square foot would have a photometric brightness of one footlambert in all directions. No actual surface completely fulfills this condition.

### *Footcandle (fc)*

The unit of illumination when the foot is the unit of length; the illumination on a surface one square foot in area on which a flux of one lumen is uniformly distributed. It equals one lumen per square foot.

### *Fluorescent lamp*

An electric discharge lamp in which a fluorescing coating ("phosphor") transforms some of the ultraviolet energy generated by the discharge into light.

### *Glare*

The effect of brightness or brightness differences within the visual field sufficiently high to cause annoyance, discomfort, or loss in visual performance.

### *Incandescent filament lamp*

A lamp in which light is produced by a filament heated to incandescence by the flow of an electric current through it.

### *Lamp*

An artificial source of light; by extension the term is also used for artificial sources radiating in regions of the spectrum adjacent to the visible. (A portable lighting unit consisting of a lamp or lamps with housing, shade, reflector, or other accessories is also commonly called a "lamp." To distinguish between such a complete luminaire and the light source within it, the latter is sometimes called a "bulb.")

### *Luminaire*

Complete lighting unit consisting of a lamp or lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply.

### *Lux (lx)*

The unit of illumination when the meter is the unit of length; equal to 1 meter-candle or 1 lumen per square meter. (Note: 1 fc equals 10.76 lux.)

### *Reflectance*

The ratio of the flux reflected by a surface or medium to the incident flux. (Note: Usually measured in percent.)

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Note: These definitions appear in *IES Lighting Handbook*, Third Edition, 1959, published by the Illuminating Engineering Society, New York, N.Y.

# SCOPE OF STUDIES

The scope of this project is confined to studies of lighting needs in multibed rooms in a general hospital. Although these studies are directed to patient rooms having two or more beds, the basic data apply equally for single-bed rooms except that glare from patients' reading lights would not present the same problem for this type of room. These data may also be applicable to health facilities other than general hospitals. However, no specific study was made for other classes of patient facilities, such as outpatient or diagnostic and treatment areas, or other types of hospitals.

The investigators for the first part of this project consisted of a team of special consultants—an electrical engineer specializing in lighting problems, a doctor of science experienced in applications of light and radiation in health facilities, and an ex-president of the Illuminating Engineering Society with broad experience in illumination problems—and the technical staff of the Division of Hospital and Medical Facilities. For the second part of the studies, a new team of consultants was selected, utilizing skills similar to those of the previous group, and including two architects.

## Facilities and Equipment Used in Determining Lighting Values

Most of the studies were conducted in experimental 2-bed or 4-bed mock-up patient rooms, where the Public Health Service staff of architects, engineers, doctors, and nurses worked with the special consultants in determining the lighting needs in such rooms. These mock-up rooms (figs. 1 and 2) were equipped with hospital beds and furniture; windows were covered to exclude daylight; and interior surfaces were aesthetically finished in various hues to provide specific colors and reflectance values. Wall and ceiling luminaires with dimmers to permit adjustments of light levels over wide ranges were installed, with provision for varying the light sources to produce

contrast conditions on the ceiling, walls, bedclothes, and surface of interest, such as a book page or chart.

In the first part of this project, studies also were done in four 2-bed patient rooms at the Clinical Center, National Institutes of Health, Bethesda, Md. Here the patients, attending nurses, and doctors were consulted on their lighting needs. These rooms were equipped with typical commercial lighting units: a ceiling-suspended concentric-ring unit; a ceiling-mounted square-box unit; a ceiling-mounted spotlight unit; and a wall-mounted rectangular unit containing fluorescent lamps. The three ceiling units had dimmers to raise or lower the lighting intensities.

Throughout the studies, lighting levels were controlled or modified by dimmers and rectifier-type switches.<sup>1</sup> Measurements were made with light meters and brightness meters. Colors and reflectances were judged according to Munsell value scales.<sup>2</sup> In addition, the reflectance values were verified by measurements with meters.

## The Lighting Problem

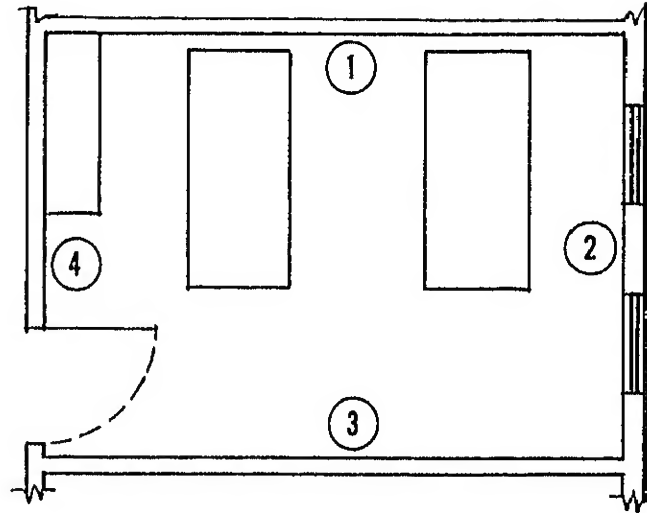
Lighting installations in hospital multibed patient rooms involve many aspects that must be considered simultaneously. The patient, the nurse, and the doctor require different illumination levels to accommodate various functions and services. The lighting levels required in the rooms range from a fraction of a footcandle for nightlighting and rest periods up to 100 footcandles or more for critical examination or treatment. Several steps of lighting levels within this range are needed for patients' use and for routine nursing service.

<sup>1</sup>Light levels controlled by: Dimmers of the autotransformer types, switches of the rectifier type providing 100 percent and 30 percent of incandescent lamp intensity, ordinary "on-off" switches, and specially made silver-bowl lamps with two elements which were controlled by a switch in each element circuit.

<sup>2</sup>Munsell value scales for judging color and reflectance: 19-step neutral scale.

*Figure 1. Typical 2-bed arrangement of patient room.*

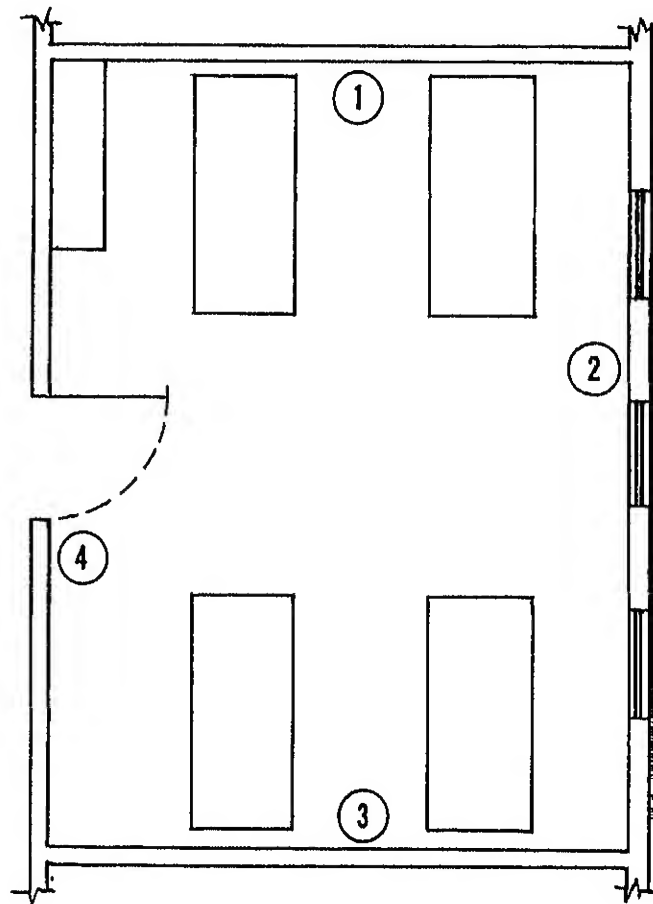
INTERIOR FINISHES		
Wall color		Reflectances (%)
① Red	-----	26
② Gray	-----	60
③ Gray	-----	50
④ Gray	-----	50
White ceiling	-----	70
Tan floor	-----	25



*Figure 2. Typical 4-bed arrangement of patient room.*

INTERIOR FINISHES		
Wall color		Reflectances (%)
① Red	-----	26
② Gray	-----	60
③ Blue	-----	40
④ Gray	-----	50
White ceiling	-----	80
Tan floor	-----	25

NOTE: Ceiling height: 8 feet 6 inches.



Although lighting for the comfort and personal needs of the patient is important, the specific lighting needs of the nurse and the doctor also must be considered. Glare from the brightness of luminaires, interior finishes, and other reflecting surfaces is a common complaint. Hence, where practicable, such brightness should be kept low enough so that seeing conditions will be comfortable for any person in the room, particularly patients, since they occupy the room continuously.

The lowest lighting level satisfactory for any particular seeing task in a multibed patient room is preferable because of the disturbing effect a higher level may have on those patients wishing to rest.

The degree of discomfort caused by glare is related to a person's physical well being. Nurses and doctors, presumably well and healthy, are not discomforted by brightnesses to the same degree as most patients. Their main problem is getting enough light at the right location to perform their tasks efficiently without subjecting the patients to high, uncomfortable brightness.

Glare is frequently caused by excessive brightnesses of room interior finishes. Both color and reflectance of interior finishes must be a part of the planning of lighting

systems in order to select lighting equipment and designs that will keep brightnesses within the limits recommended (see "Tentative code of lighting levels and brightnesses," page 9). Gloss finishes should be avoided.

If only minimum levels of lighting were to be supplied for all the functions performed in patient rooms (see appendix A), the lighting equipment would be too complex and costly. Fortunately, several functions and seeing tasks may be satisfied by one lighting level. Hence, relatively few steps of lighting levels will suffice for the entire range of lighting needs, permitting them to be met in a practicable and simple manner and at reasonable cost.

The use of color in patient rooms also is related to lighting. Customary environment becomes very important, not only for the patient, who wishes to appear as healthy to himself and friends as he would under general environmental conditions, but for those rendering care. A basic illumination requirement in the hospital is that the appearance of the patient be viewed under "normal" lighting conditions so that the doctors and nurses can detect at a glance any clinical changes of the skin, mucous membranes, or eyes.

## LIGHTING NEEDS

### Lighting Practices and Requirements Surveyed

To determine the lighting practices of hospitals and the purpose for which illumination is needed, the consultants surveyed a number of hospitals, conducted interviews with personnel and patients, and studied the literature on hospital lighting. Visits were made to old and new hospitals in New York and New Jersey and to recently constructed facilities in the southeastern part of the Nation. In addition, an analysis of the activities and procedures involved in medical and nursing care for which electric lighting is required in a patient room was made by a physician and nurse of the Professional Services Branch, Division of Hospital and Medical Facilities, Public Health Service. This phase of the study, reported by Dr. Bruce Underwood, is summarized in appendix A.

For the more complicated medical and nursing procedures suggested by Dr. Underwood, an intensive study of the lighting needs for treatment and nursing care was done at the Clinical Center of the National Institutes of Health. Staff members, representing the medical and nursing fields, made observations on brightness, glare, and comfort. Nurses, doctors, and auxiliary personnel were asked to state their preferences as to minimum and optimum lighting levels for their various functions in the rooms. Each situation was assessed by adjusting the illumination repeatedly, by means of a dimmer, to higher and lower lighting levels. Photometer readings for each specific situation were averaged.

Comfortable lighting conditions for patients' reading also were investigated by varying the illumination on the reading matter and the brightness on the ceiling.

From the observations mentioned, it is evident that a multiple problem is encountered in providing electric lighting in hospital patient rooms containing two or more

occupied beds. To provide a comfortable seeing environment for patient use during the usual waking hours, general lighting of a low level, about 10 footcandles, be provided. Substantially higher levels of illumination may produce an undesirable condition of direct or reflected glare within direct view of patient. The maximum general lighting suitable for patient use is usually adequate for routine nursing care, but insufficient for detailed reading of thermometers, charts, instruments, and other data. Although the patient's reading light be used for this purpose, such practice is not desirable because it usually requires placing the data in the patient's visual field.

For more critical examination at the patient's bedside, a higher level of illumination will be needed by the physician or nurse. A separate unit should be installed or furnished for this purpose, as the patient's reading light is considered inadequate for medical examination. When the examination light is used for relatively short periods of time, the higher level of illumination and the associated brightnesses could be tolerated by patients in the patient room without undue discomfort.

When patients sleep or rest, a nightlight is needed to provide only a low level of illumination to enable the nurse to enter and move freely around the room; to enable patients to orient themselves and to attend to their personal self care if awakened at night; and to enable ambulatory patients to find their way to lavatories. This source of light should be suitably placed so as not to disturb patients who may be awake.

### Common Deficiencies in Patient Room Lighting

The common deficiencies noted in patient room lighting are: insufficient amount of light at locations

needed; excessive amount of light causing uncomfortable glare in some places; and no examination light installed in the room.

The usual causes for complaint from patients are: glare from brightness of light sources and reflecting surfaces; spotty appearance of general lighting caused by abrupt or excessive variations in brightnesses of adjacent surfaces; heat that radiates from reading light; reading light that is hot to the touch; insufficient light for reading; reading light in wrong location; excessive illumination and/or glare from nightlight; and annoyance or disturbance due to location of the nightlight.

The usual causes of complaint from the hospital staff are: insufficient general illumination for routine nursing care or for cleaning the room; insufficient or incorrect type of light for examinations, giving intravenous injections, changing dressings; and other critical seeing tasks pertinent to patients' care.

## Recommended Lighting Levels

Because of the many functions performed in a single room, the problem is not the academic one of the best illumination for each procedure but the practical one of providing illumination satisfactory for the most difficult visual task. Since the illumination for the most difficult task will only be needed periodically, the installation should be controlled so as to provide a selection of lower steps of illumination reasonably satisfactory for other tasks.

From these studies and the review of the literature, the lighting levels shown in table I are recommended.

**Table 1.—Lighting levels recommended for patient rooms**

<i>Lighting needs in patient rooms</i>	<i>Minimum lighting levels (Footcandles)</i>
1. For patient comfort:	
a. Head of bed for reading-----	20-30
b. Foot of bed-----	5-10
2. Lighting for nursing service:	
a. General, for nurse to observe patient----	2
b. Reading thermometers, charts, directions -----	10-15
3. General illumination for cleaning and routine nursing service-----	10
4. Local lighting for critical examination by doctor or nurse-----	50-100

Note: Recommendations on brightness limitations which were developed during Part II of these studies are presented on the following page.

## DEVELOPMENT OF LIGHTING RECOMMENDATIONS

The findings of the first part of the studies point to the incompatibility—and difficulty—in providing lighting levels for (1) patient-use illumination localized and minimized to be acceptable to another patient in the same room; (2) general illumination sufficient for routine nursing care; and (3) higher lighting level over the whole bed for critical examinations when glare for a few minutes may be the least of the patient's discomfort. To what extent it may be practical to provide these three types of illumination by less than three separate lighting fixtures was explored in the second part of the project.

In Part II an evaluation was made of lighting characteristics of various types of luminaires, both commercially available units and experimental units. Details of these case studies are shown in figures 3–18. From the combined studies, the following tentative code of lighting levels and brightnesses was developed. Guidance in the use of this information is given under "Advisory Recommendations" (page 28).

### Tentative Code of Lighting Levels and Brightnesses

The levels of lighting needed for particular seeing tasks and the brightnesses which can be tolerated comfortably are not definite values and may vary greatly, depending upon the user's needs and the patient's physical or mental condition. However, for code purposes, definite lighting values are specified below. The practicality of these lighting levels and brightnesses was checked when the lighting characteristics of various types of luminaires (figs. 3–18) were evaluated.

#### Lighting Levels: Footcandles (fc)

*Nightlighting:* 0.5 fc, maximum, on floor, at a distance of 3 feet from the luminaire. It is desirable to provide  $1\frac{1}{2}$  fc for momentary use.

*Observation lighting:* 2 fc, maximum, 3 feet above floor, for nurse to see the patient's apparent condition, fluid drainage, oxygen therapy equipment, and to make similar observations without the need for additional lighting.

*General lighting:* 10 fc, for cleaning, routine nursing service, patient's self-care, visitors, dining, and as background lighting for use with reading light.

*Reading lighting:* 20–30 fc, 3 feet 9 inches above floor, on reading material of patient in bed or in chair.

*Examination lighting:* 50–100 fc, for use of doctor and nurse to make critical examinations, to administer treatments such as intravenous injections, to change dressings, and to give other medication necessary for the care of patients.

#### Tolerable Brightness Limits: Footlamberts (fL)

*General light and reading light:* 90 fL, maximum brightness of any luminaire, light source, or room interior surface as normally seen from any normal reading or patient's bed position.

*Nightlight:* 20 fL, maximum brightness normally produced on or by the nightlight as observed from any normal bed position. The maximum brightness for momentary use should not exceed 50 fL.

*Examination light:* 250 fL, maximum brightness of a fixed nonadjustable luminaire as seen from adjacent beds or from beds across the room, from a normal bed position.

#### Luminaire Types and Service Features

Luminaires, which consist of complete lighting units or components of lighting units, are commonly used in patient rooms for one or more of the following services:

patient's reading light, general lighting, examination light, and nightlighting. Several variations in the combination of service features have been incorporated into commercial units presently available. For example, a patient's reading light is usually combined with some type of general lighting component and frequently with a nightlight. Characteristics of these lighting service features are as follows:

*Reading lights* are supplied in adjustable and non-adjustable types, arranged for mounting on wall, bed, or ceiling, or they may be portable types such as table lamps and floorlamps. Adjustable and portable units require more maintenance than nonadjustable types because of movable parts and breakage by patients who may misuse them when attempting to raise themselves in bed. Extension cords connecting portable lamps are dust-catchers and dust-distributors and may constitute a tripping hazard.

*General lighting* for the room is usually provided by ceiling-mounted units, wall brackets, table lamps, or floorlamps. The ceiling-mounted luminaires permit a more even distribution of lighting throughout the room than the wall-bracket luminaires and are relatively economical. The conventional types of wall-bracket units, table lamps, and floorlamps that are commonly used to provide general lighting are either deficient in lighting levels or distribution, high in brightness, or unsatisfactory for proper maintenance.

*Examination lights* used as local lighting by the doctor or nurse to examine or treat patients are often provided by ceiling-mounted nonadjustable units, wall brackets with adjustable arms, or portable spotlights of the floorstand and the hand-held types. Installed units

do not interfere with the use of both hands or free movement of the doctor or the nurse while examining or treating patients.

*Nightlighting* of low level is needed in patient rooms for the nurse to see as she enters and as she moves within the room, for patients to orient themselves if awakened at night, and if necessary, for their immediate self-care. A reduction in this low level is desirable when the patient rests or sleeps. Nightlights are not intended to supply enough light for the nurse to observe the patient's face or to render nursing service, but rather to detect whether additional light may be needed for the patient's care. The preferred location for the nightlight is near the floor adjacent to the room entrance to permit a minimum, but sufficient, amount of lighting for the nurse to enter the room and to provide a subdued environment for the patient.

## Luminaire Case Studies

Many different types of commercial luminaires commonly used in patient rooms, as well as experimental lighting units, were installed in the mock-up rooms where illumination characteristics, brightnesses, glare, maintenance features, and control were studied. These case studies, as shown in figures 3-18, are not intended to identify, praise, or censure any luminaire, but to determine the typical characteristics of the component parts of each type. All lighting units were installed in accordance with the recommendations of the manufacturers.



**Figure 3. Ceiling-mounted luminaire: Public Health Service experimental unit.**

*Service:*

Combination unit: reading, examination, and general lighting.

*Lamps:*

Two 40-watt fluorescent lamps (deluxe warm)

One 150-watt reflector flood

One 150-watt projector flood

*Brightness:*

Footlamberts measured at intervals across wall and ceiling indicated by encircled numerals.

*Illumination:*

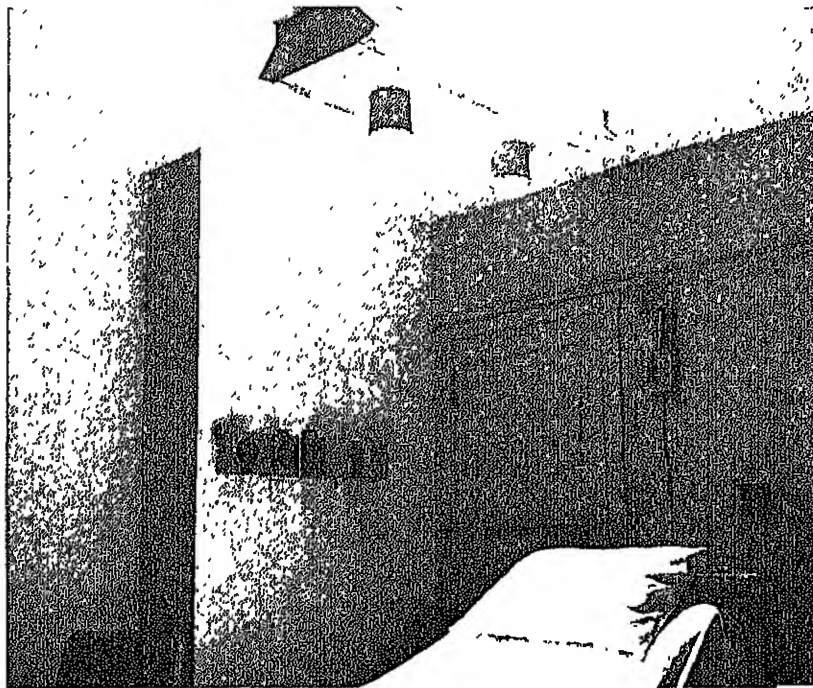
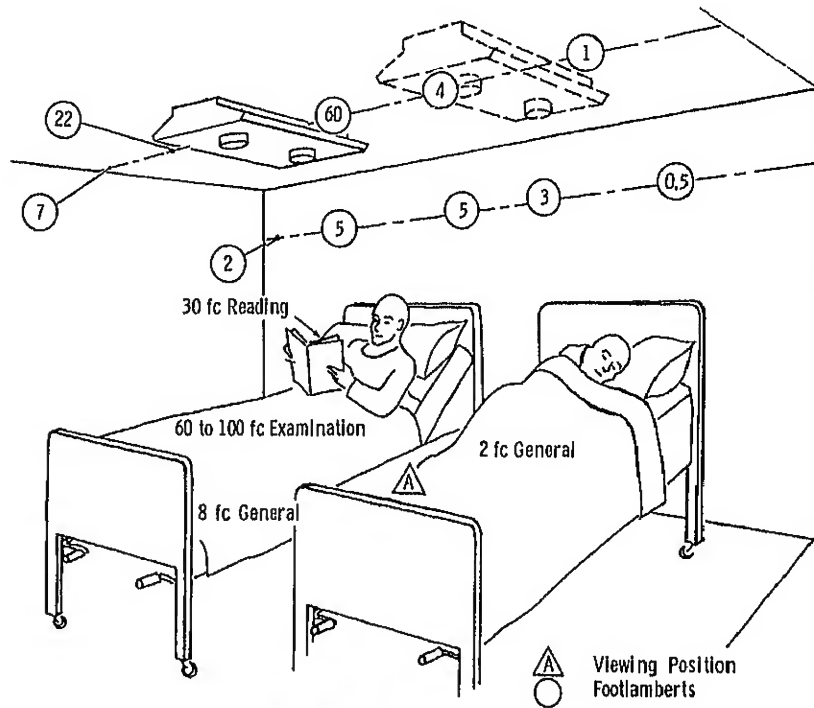
Lighting levels in footcandles indicated by numerals on beds and reading matter.

*Interior finishes:*

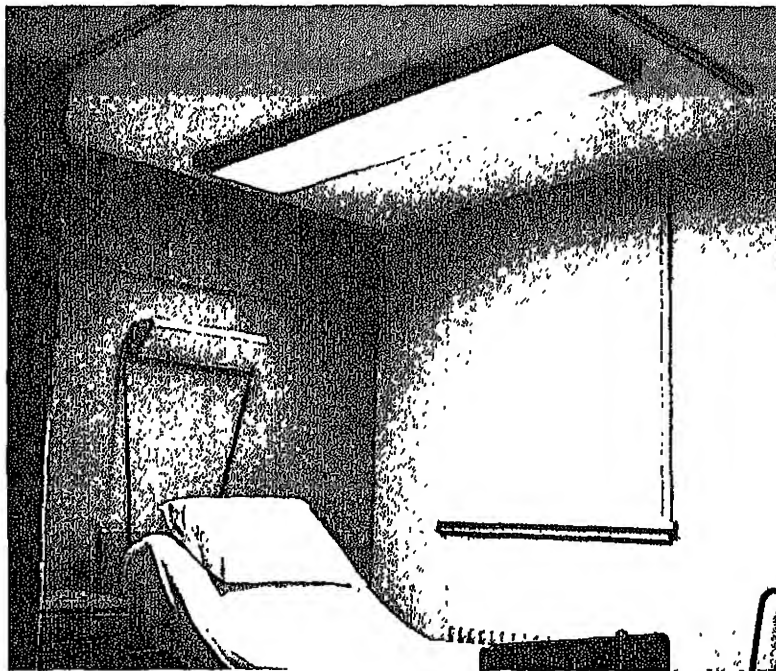
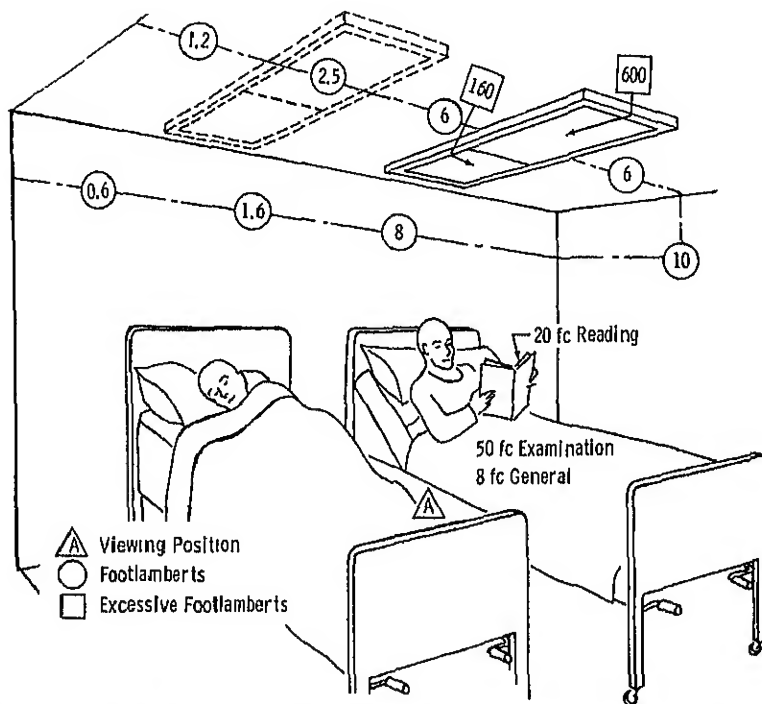
Colors and reflectances: Head walls—red, 26 percent; ceiling—gray, 70 percent.

*Remarks:*

The two fluorescent lamps, switched separately, provide two sources of indirect general illumination, arranged so that either one or both sources may be used as desired. The reflector floodlight is for reading. Both the reflector flood and the projector floodlights constitute the examination light. All of these components provide the lighting levels and low brightnesses recommended. However, the reading and examination lights are nonadjustable and thereby are limited to lighting a predetermined area.



**Figure 4. Ceiling-mounted luminaire (may be recess-mounted).**



**Service:**

Combination unit: reading, nightlight, examination light, and general lighting.

**Lamps:**

Four 20-watt fluorescent  
Three 40-watt fluorescent  
One 6-watt incandescent

**Brightness:**

Footlamberts measured at intervals across ceiling, walls, and face of luminaire indicated by numerals in circles and squares. The numerals in squares indicate excessive brightnesses.

**Illumination:**

Lighting levels in footcandles indicated by numerals on bed and reading matter.

**Interior finishes:**

Colors and reflectances: Head walls—red, 26 percent; ceiling—gray, 70 percent.

**Remarks:**

The fluorescent lamps are switched to provide the following combinations of lamps for general, reading, and examination lights: two 20-watt general, four 20-watt reading, four 20-watt, and three 40-watt examination. The lighting provided by these lamp combinations for the services stated produces the lighting levels recommended, but the brightnesses are excessive. The large lighted area provided by the reading light allows the patient considerable freedom of movement within the area lighted for reading. However, the nightlight, located at the foot end of the luminaire, exceeds the brightness recommended. Its brightness and location are objectionable to most observers.

**Figure 5. Ceiling-suspended concentric-ring luminaire, indirect lighting.**

**Service:**

General lighting

**Lamps:**

One 150-watt incandescent, silver bowl, controlled by high-low switch.

**Brightness:**

Footlamberts measured at intervals across ceiling and wall indicated by numerals in circles and square. The numeral in square indicates excessive brightness.

**Illumination:**

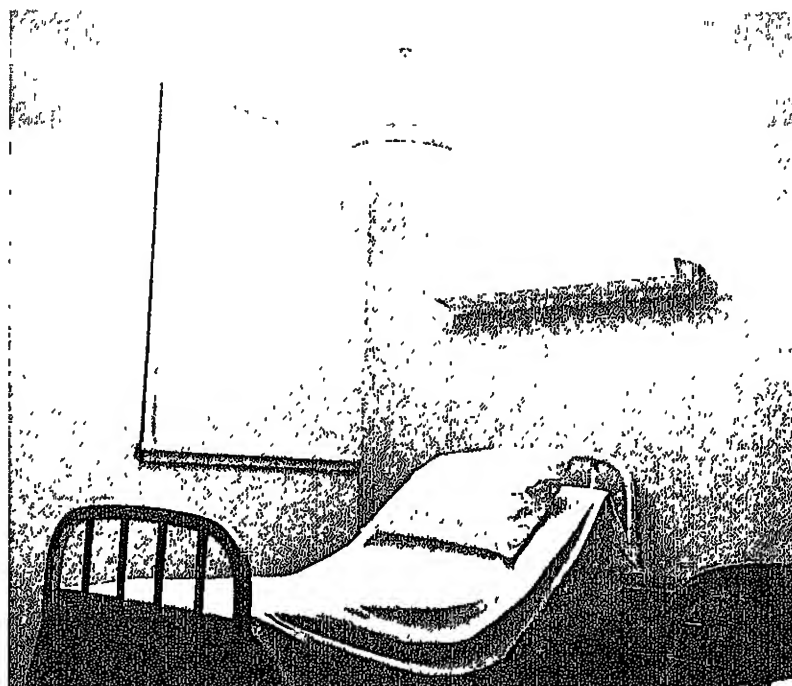
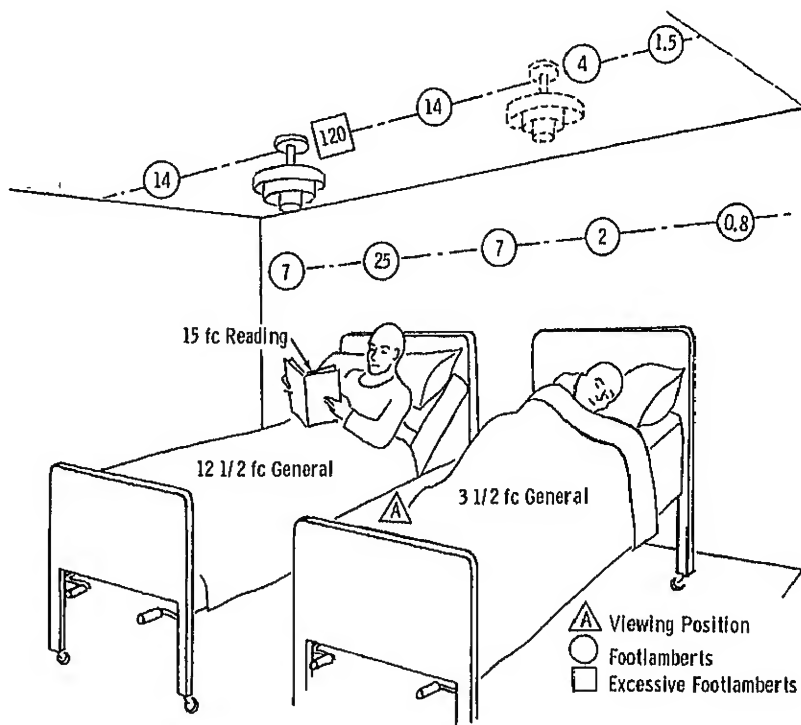
Lighting intensities in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

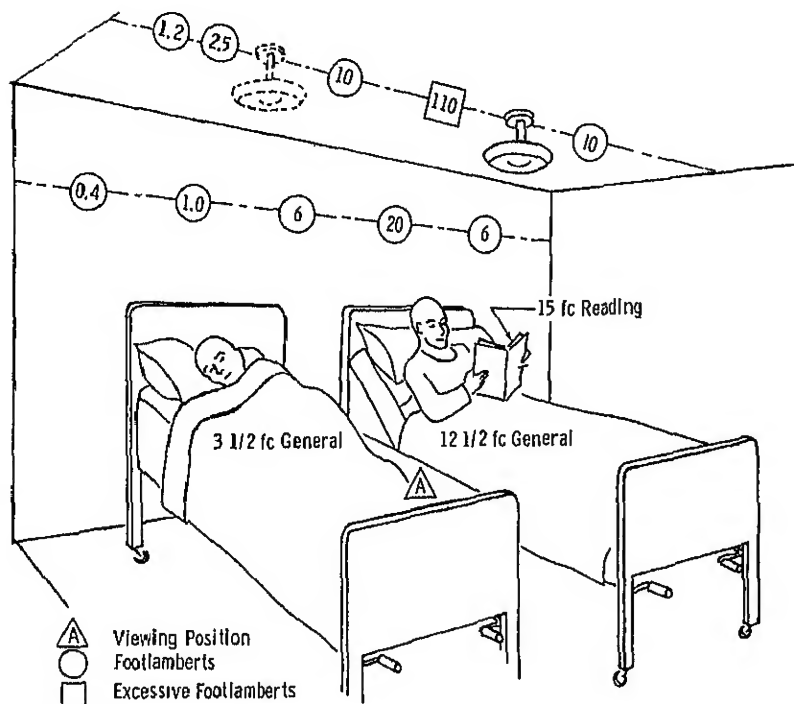
Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

This light controlled by a high-low switch, provides two lighting levels. In the sketch are shown lighting levels and brightnesses as produced with a high-low switch in "high" position. When the switch is in "low" position these levels and brightnesses are reduced about 70 percent.



**Figure 6. Ceiling-suspended luminaire with plastic diffusing louvers, indirect lighting.**



**Service:**

General lighting

**Lamps:**

One 500-watt incandescent, silver bowl, dimmer controlled.

**Brightness:**

Footlamberts measured at intervals across ceiling and wall indicated by numerals in circles and square. The numeral in the square indicates excessive brightness.

**Illumination:**

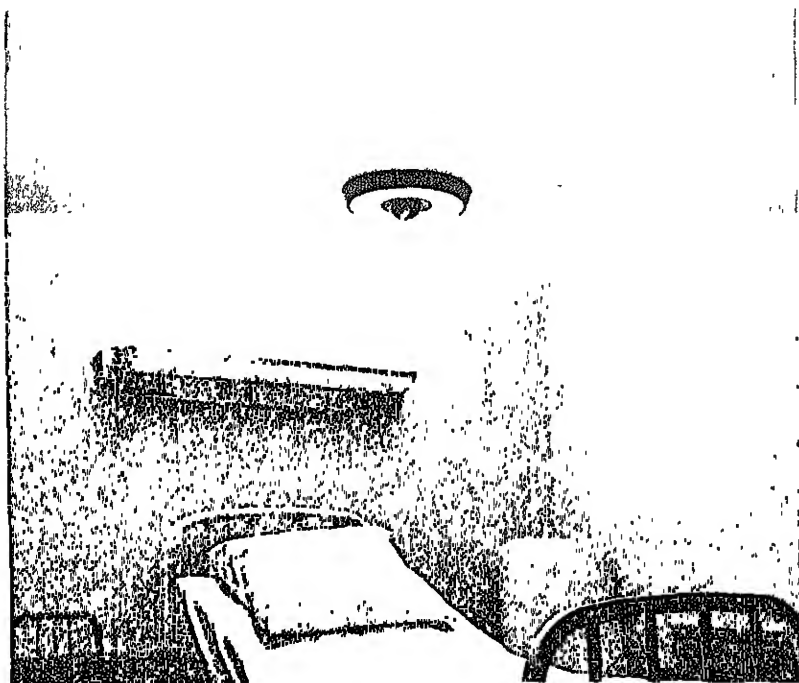
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

The lighting levels produced by this luminaire are controlled by a dimmer which permits adjustments over a range from 0 to 50 footcandles at bed level, 30 inches above the floor. When the dimmer is adjusted to provide 12 1/2 footcandles at bed level, the brightnesses are as shown above. When the light is adjusted by the dimmer to provide the lighting levels recommended for reading or for examinations, brightnesses on ceiling and walls exceed the limit recommended.



**Figure 7. Ceiling-suspended luminaire with opaque shade.**

**Service:**  
General lighting

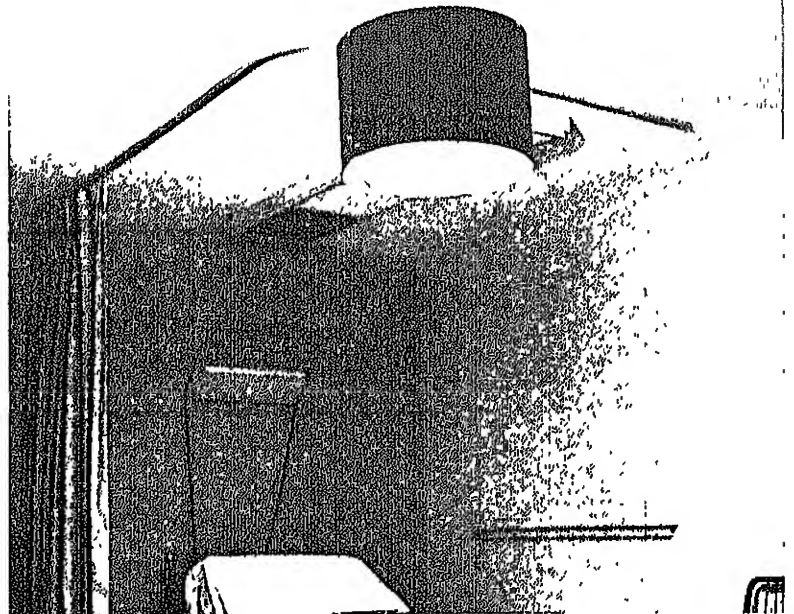
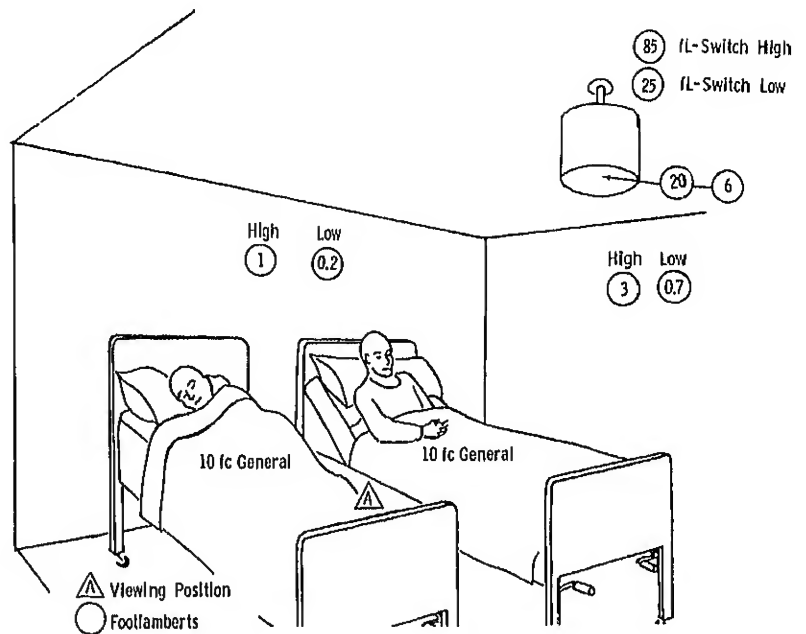
**Lamp:**  
One 150-watt incandescent, controlled by high-low switch, general lighting.

**Brightness:**  
Footlamberts indicated by encircled numerals for high and low positions of switch.

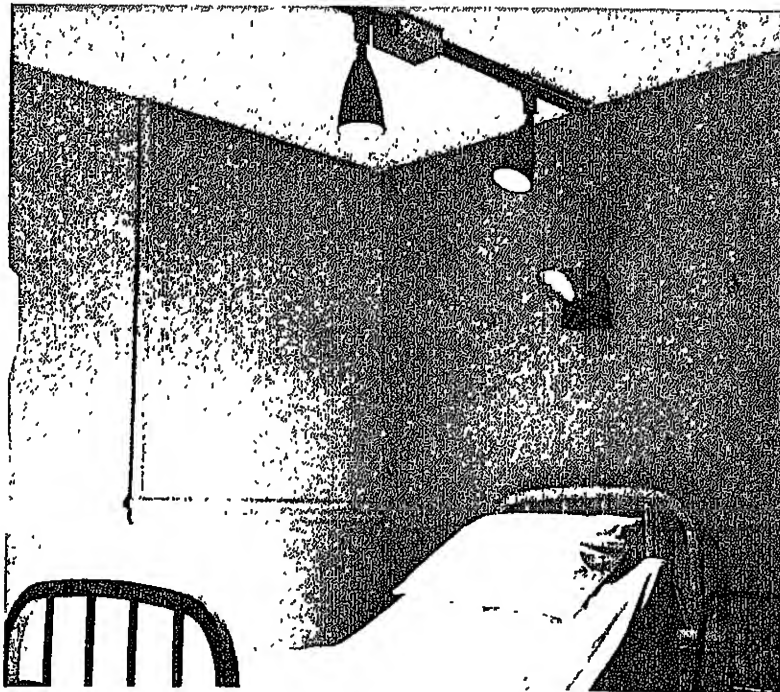
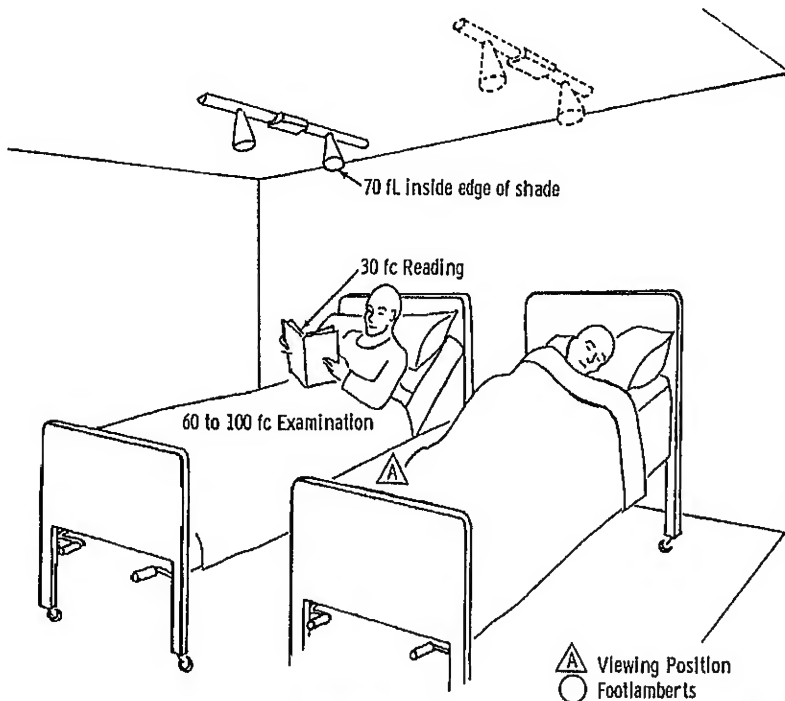
**Illumination:**  
Lighting levels in footcandles shown at points indicated.

**Interior Finishes:**  
Colors and reflectances: Head wall—red, 26 percent; side wall—gray, 60 percent; ceiling—white, 80 percent.

**Remarks:**  
This luminaire is suspended from the center of the ceiling of a 4-bed ward and is controlled by a high-low switch. When the switch is in "high" position, this unit provides 10 footcandles 30 inches above the floor over a large area and has a cutoff of direct view of the lamp at about knee position on the beds. When the switch is in "low" position, 3 footcandles are provided. The usefulness of this type of luminaire is limited by low ceiling height. However, the indirect lighting reflected from the ceiling, plus the direct lighting confined to a wide control area, produce a restful and pleasant environment.



**Figure 8. Ceiling-mounted floodlights: experimental lighting unit.**



**Service:**

Combination reading and examination lights: Study assembly of two swivel-type adjustable hooded downlights.

**Lamps:**

One 150-watt reflector flood. One 150-watt projector flood.

**Illumination:**

Footlamberts measured at inside bottom edge of shade. Lighting levels in footcandles are indicated by numerals on bed and reading matter.

**Interior Finishes:**

Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

This experimental unit, consisting of floodlights attached to a bus mounted on the ceiling, permits adjustment of the spacing between the downlights and the direction of the light beam. The purpose of this lighting unit was to determine the characteristics and usefulness of similar ceiling-mounted units when used for reading and examination lights. When the reading unit is adjusted to angle the beam forward, as shown, additional shielding is necessary to protect patients on the opposite side of the room from excessive brightness. This type of reading light with no background illumination produces an unpleasant lighting environment.

**Figure 9. Wall-mounted bracket light with translucent shade, indirect lighting.**

**Service:**

Combination reading light, nightlight, and indirect light for general illumination.

**Lamps:**

One 75-watt incandescent, for general lighting. One 100-watt incandescent, for reading. One 6-watt incandescent nightlight.

**Brightness:**

Footlamberts measured at intervals across ceiling and wall indicated by numerals in circles and squares. The numerals in the squares indicate excessive brightnesses.

**Illumination:**

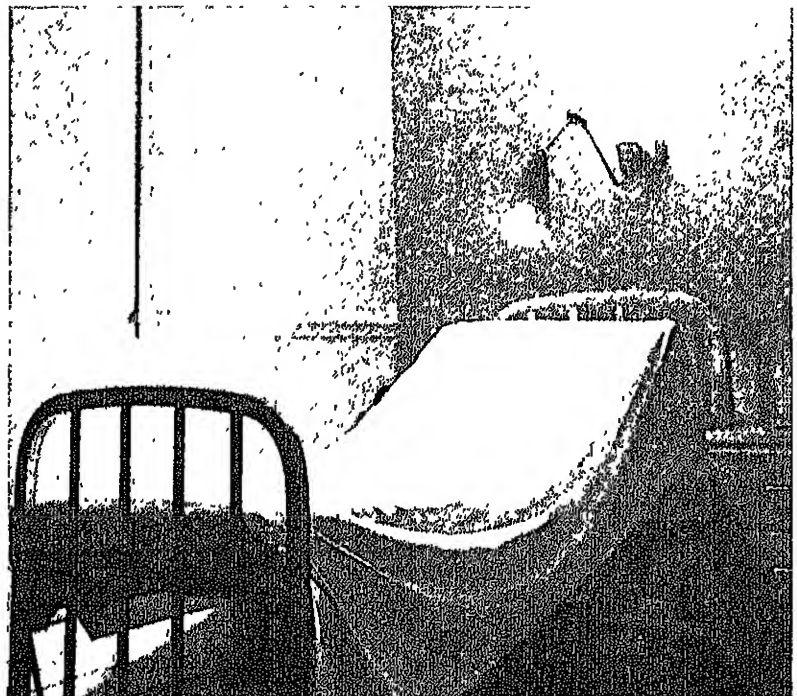
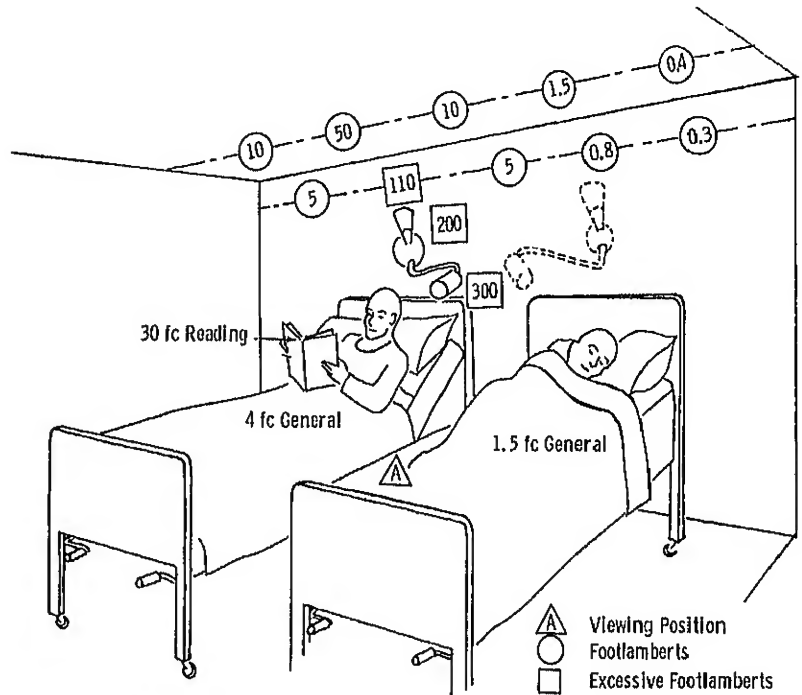
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

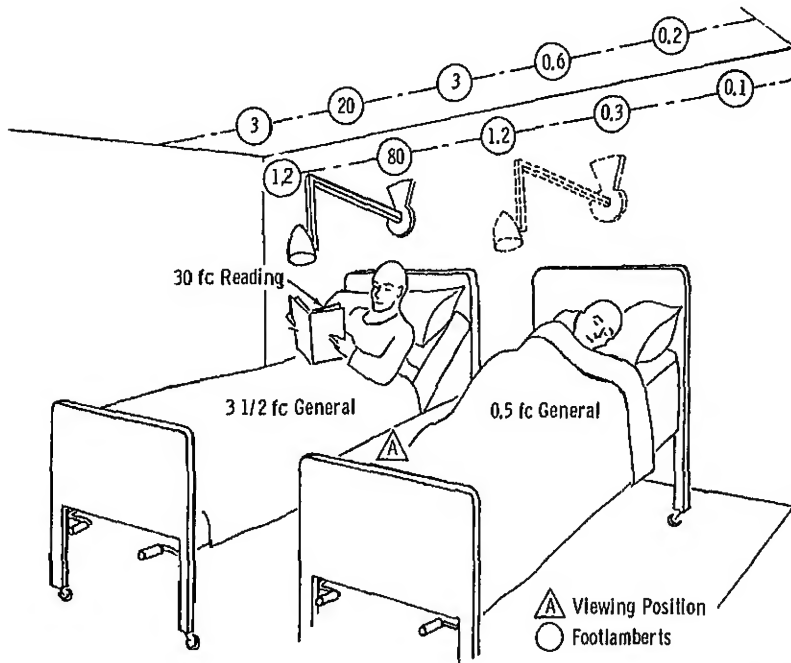
**Remarks:**

The adjustable reading light provides adequate illumination, but the luminaire may be maladjusted and thus shine in another patient's eyes. The brightness of the translucent shade of the general lighting component exceeds the limit recommended. The night lighting component of units of this type provides inadequate illumination for nurses to see furniture or other objects on the floor.





**Figure 10. Wall-mounted bracket light with opaque shade, indirect lighting**



**Service:**

Combination reading light, nightlight, and indirect light for general illumination.

**Lamps:**

One 75-watt incandescent, for general lighting  
 One 60-watt incandescent, for reading  
 One 6-watt incandescent nightlight

**Brightness:**

Footlamberts measured at intervals across wall and ceiling indicated by encircled numerals.

**Illumination:**

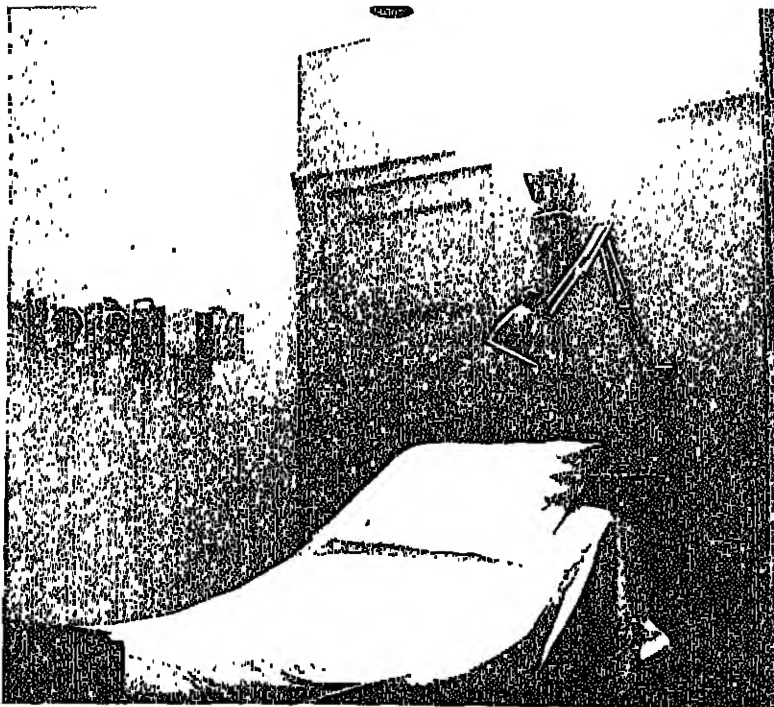
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

Colors and reflectances: Head wall—red, 26 percent; ceiling—white, 80 percent.

**Remarks:**

The adjustable reading light, which is not fixed to the wall bracket provides adequate illumination and is essentially a portable unit provided with a bayonet-type fitting that may be inserted into any available socket, such as in a wall bracket, clamp-on bracket, intravenous rod receptacles on the corner of beds, or on a heavy base placed on a bedside table or dresser. Although it is possible to maladjust the light to shine in another patient's eyes, the unit is constructed to minimize this probability. The general lighting component does not provide the recommended illumination. Observation pertaining to the nightlight is similar to that stated for figure 9.





**Figure 11. Wall-mounted luminaire, fluorescent and incandescent, including examination light.**

**Service:**

Combination reading, examination, and semi-indirect light for general illumination

**Lamps:**

Two 40-watt fluorescent (deluxe warm), for general lighting

One 20-watt, 28-volt incandescent, for reading

Two 20-watt, 28-volt incandescent, for examination

**Brightness:**

Footlamberts measured at intervals across wall and ceiling indicated by encircled numerals.

**Illumination:**

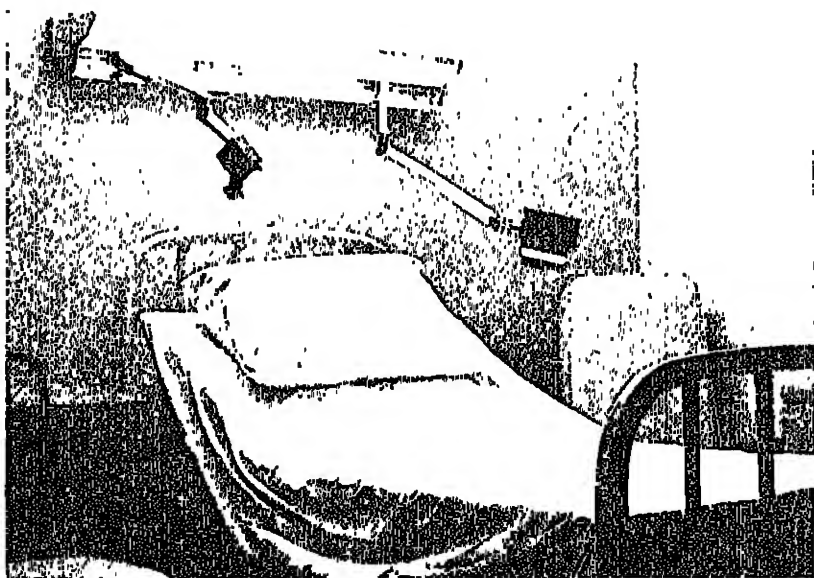
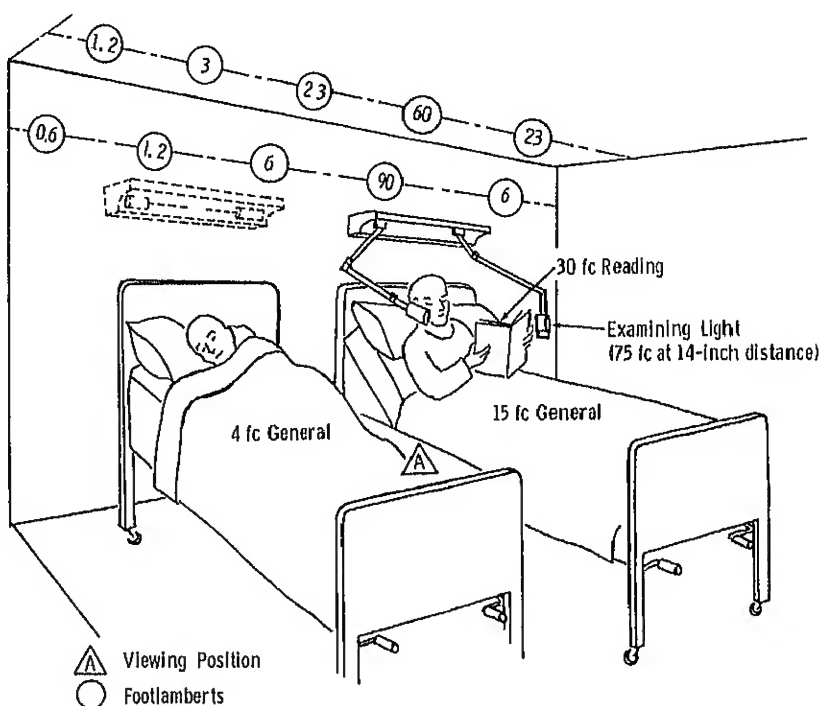
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

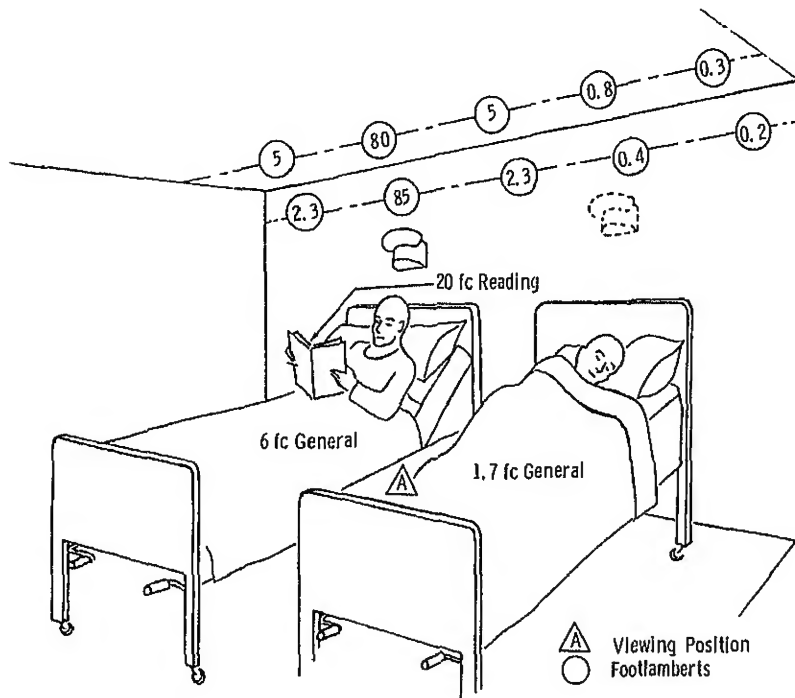
Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

The level of general lighting, provided by the two fluorescent lamps, is within the limit recommended. This light is well diffused and distributed over a large area of wall and ceiling. The reading light, provided by one 20-watt lamp mounted on an adjustable arm, permits the patient to adjust the light to suit the reading position selected. However, the light may be maladjusted to shine in another patient's eyes. The examination light, provided by two 20-watt lamps on another adjustable arm, permits positioning of the light as needed by the nurse or the doctor. This light also is subject to maladjustment, as pointed out for the reading light. Both reading and examination lights provide the recommended lighting levels.



**Figure 12. Wall-mounted luminaire, incandescent.**



**Service:**

Combination reading light, nightlight, and indirect light for general illumination.

**Lamps:**

One 100-watt incandescent, for general lighting  
 One 100-watt incandescent, for reading  
 One 6-watt nightlight

**Brightness:**

Footlamberts measured at intervals across ceiling and wall indicated by encircled numerals.

**Illumination:**

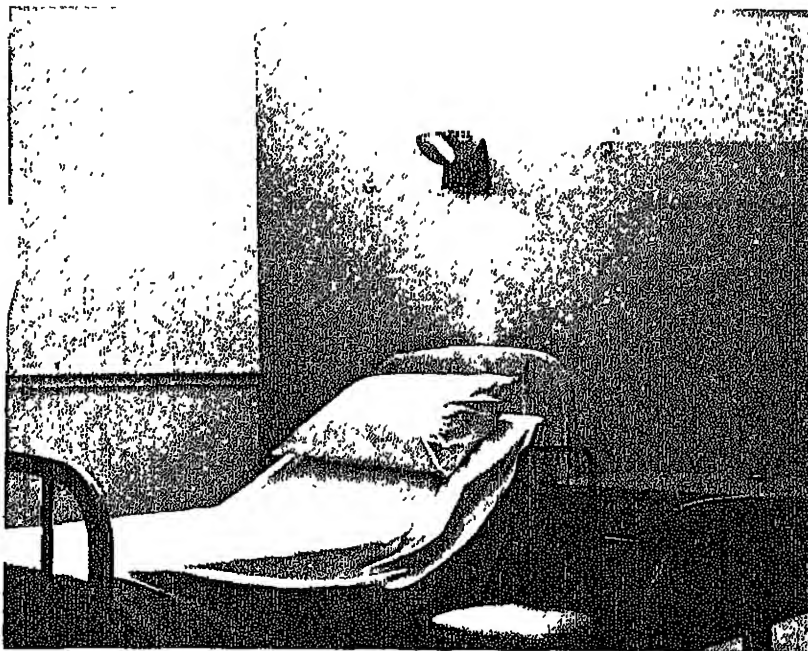
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

The nonadjustable reading light provides adequate illumination; however, it is limited to a predetermined area. The general lighting level is less than that recommended when using a 100-watt lamp. If a 150-watt lamp is used, the illumination is sufficient but the brightnesses of the ceiling and wall are excessive. The night-light features are the same as described for figure 9.



**Figure 13. Wall-mounted luminaire, fluorescent.**

**Service:**

Combination reading and indirect light for general room illumination

**Lamps:**

One 40-watt fluorescent, for general lighting  
One 40-watt fluorescent, for reading

**Brightness:**

Footlamberts, measured at intervals across ceiling and walls, indicated by encircled numerals. The numeral in the square indicates excessive brightness.

**Illumination:**

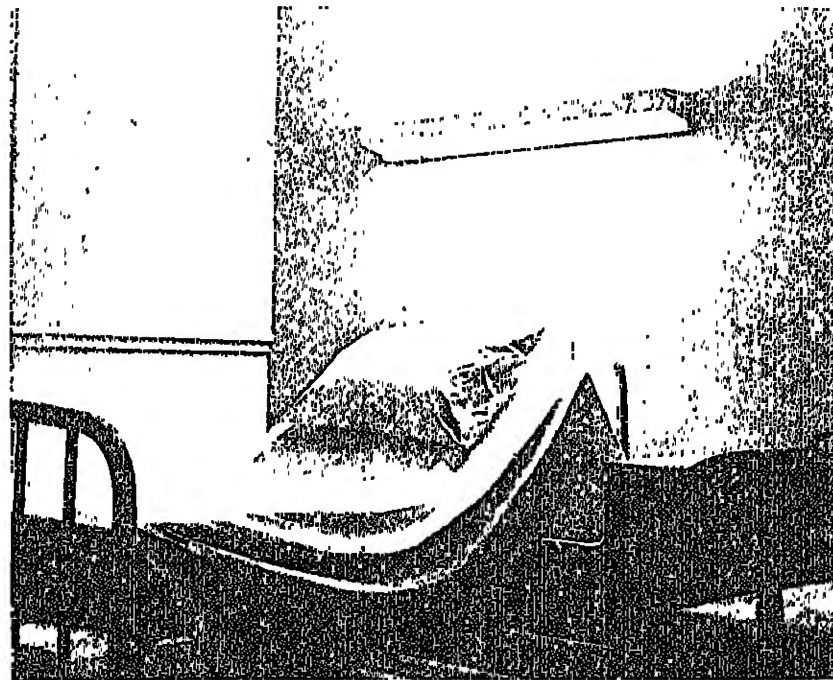
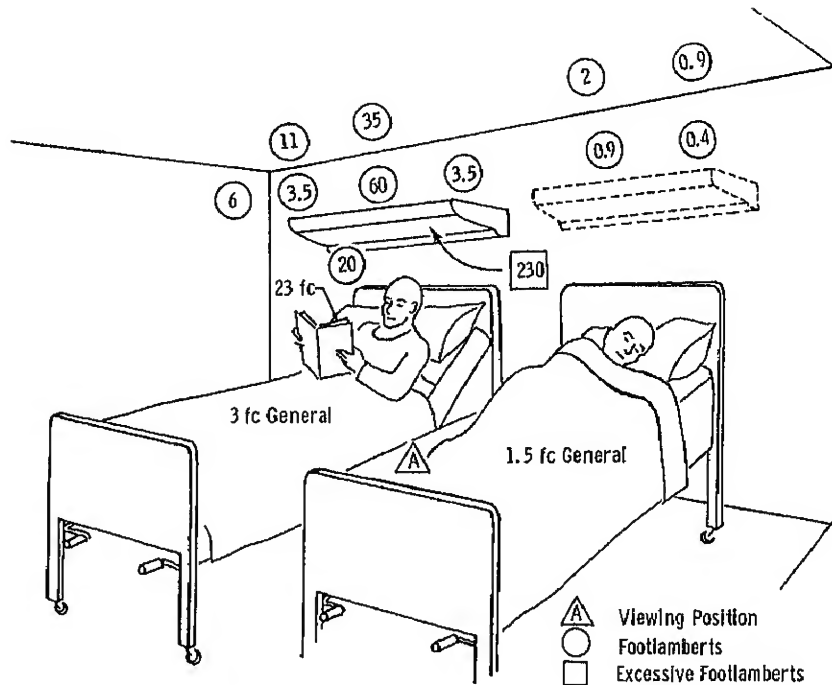
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

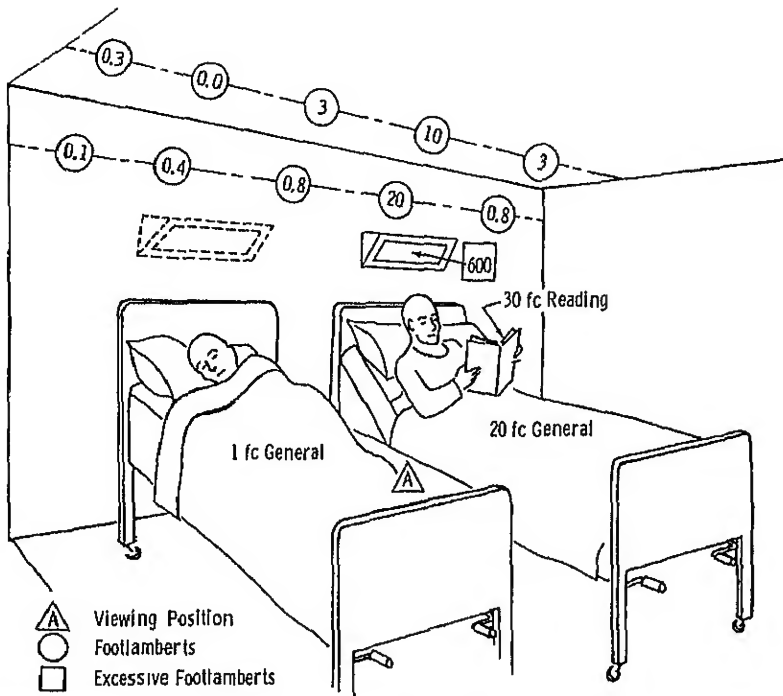
Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

This type of luminaire provides the lighting level recommended for reading, and spreads the light over a relatively large area, as is desirable for this purpose. However, the brightness, as viewed from an adjacent bed or the bed on the opposite side of the room, greatly exceeds the recommended limit. The level of the general lighting provided by one fluorescent lamp is below that recommended; however, with both fluorescent lamps on, the general lighting level is within the limit recommended.



**Figure 14. Wall-mounted bracket lowered reading light.**



**Service:**

Reading light with indirect general lighting component

**Lamps:**

Two 20-watt fluorescent

**Brightness:**

Footlamberts measured at intervals across ceiling and wall indicated by numerals in circles and square. The numeral in the square indicates excessive brightness.

**Illumination:**

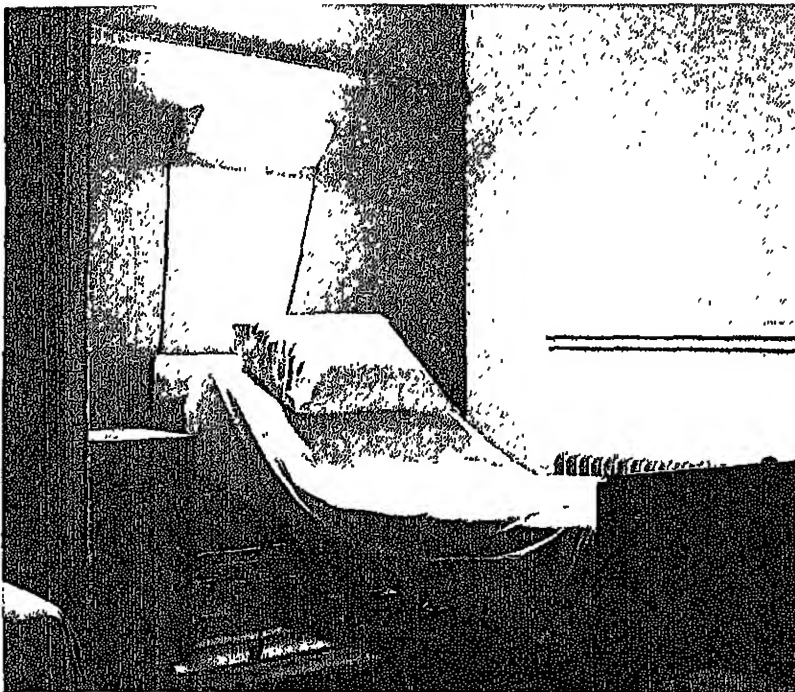
Lighting levels in footcandles indicated by numerals on beds and reading matter.

**Interior Finishes:**

Colors and reflectances: Head wall—red, 26 percent; ceiling—white, 80 percent.

**Remarks:**

This type of luminaire provides the lighting level recommended for reading and spreads the light over a relatively large area, as is desirable for reading. However, the brightness, as viewed from an adjacent bed or the bed on the opposite side of the room, greatly exceeds the recommended limit.



**Figure 15. Floorlamp portable-type luminaire.**

**Service:**

Reading, general illumination, examination, and nightlight

**Lamps:**

One 100-watt incandescent, for general lighting

One 6-watt incandescent, for general lighting

**Brightness:**

Footlamberts measured on ceiling and inside bottom edge of shade are indicated by numerals in circle and square. The numeral in the square indicates excessive brightness.

**Illumination:**

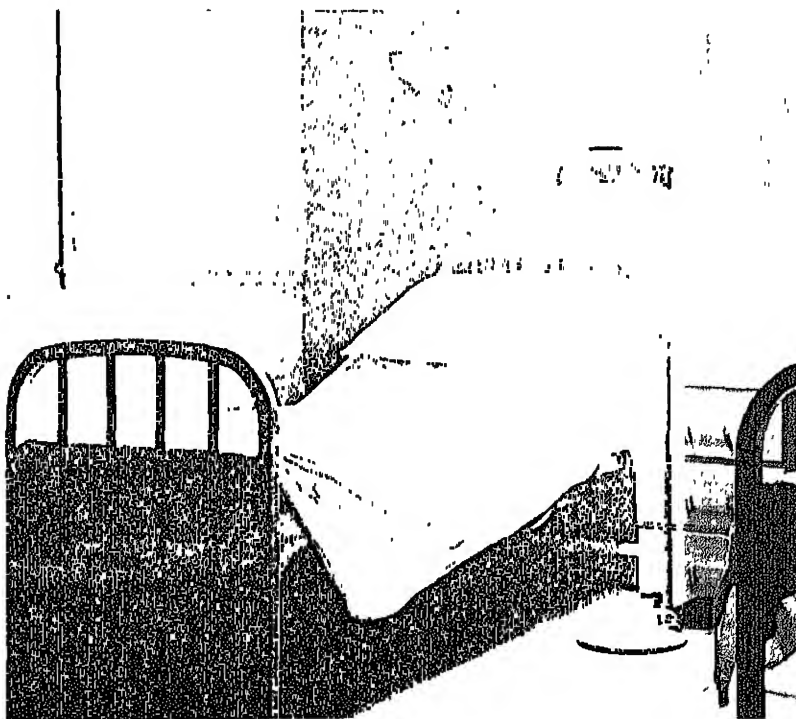
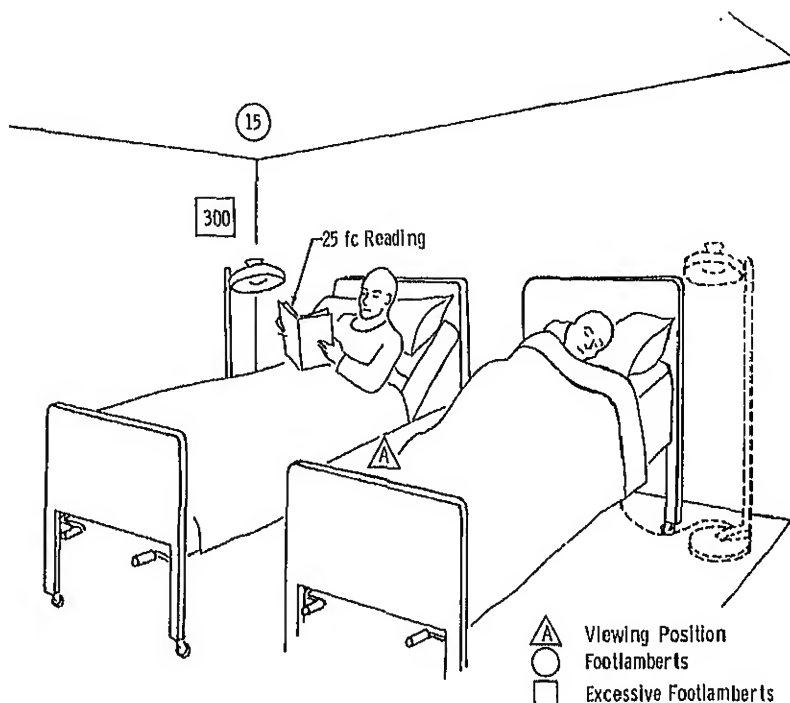
Lighting level in footcandles indicated by numeral for reading matter.

**Interior Finishes:**

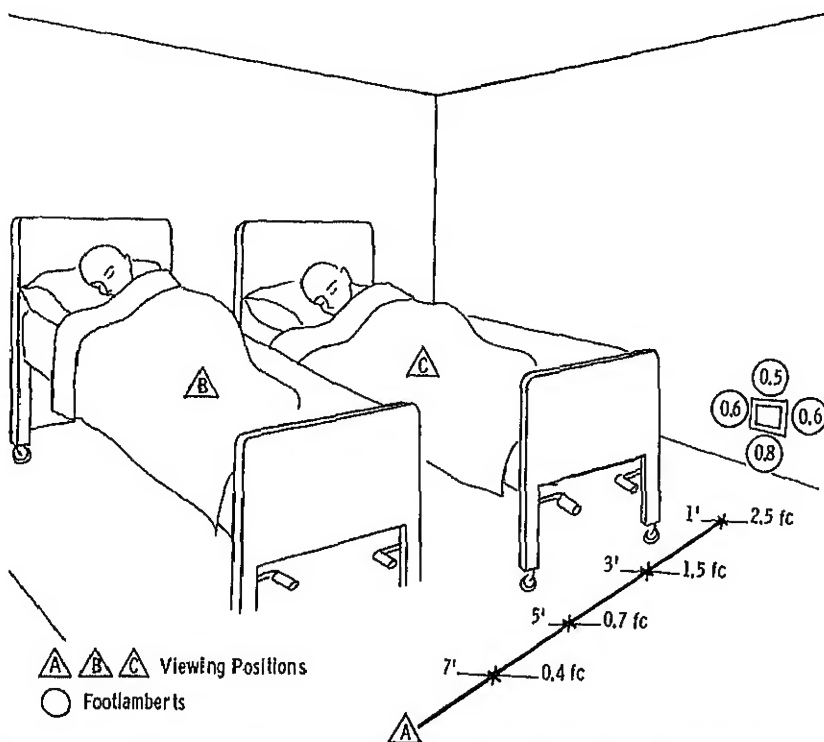
Colors and reflectances: Head wall—blue, 40 percent; ceiling—white, 80 percent.

**Remarks:**

This luminaire is provided with a reflector unit that may be adjusted for reading, examination, or general lighting. When the shade is properly adjusted for reading, this fixture provides the recommended illumination, but if maladjusted, can cause discomfort glare to other patients. When the shade is adjusted for either examination or general lighting, the lighting levels are below the values recommended for these services. The nightlight in the base of the lamp reflects light parallel to the floor, but is limited to a small area. The connecting cord for this type of light is an undesirable dust catcher and tripping hazard.



**Figure 16. Wall-mounted nightlight with crystal glass prismatic lens.**



**Service:**  
Nightlight

**Lamps:**  
One 10-watt incandescent, controlled by a high-low switch

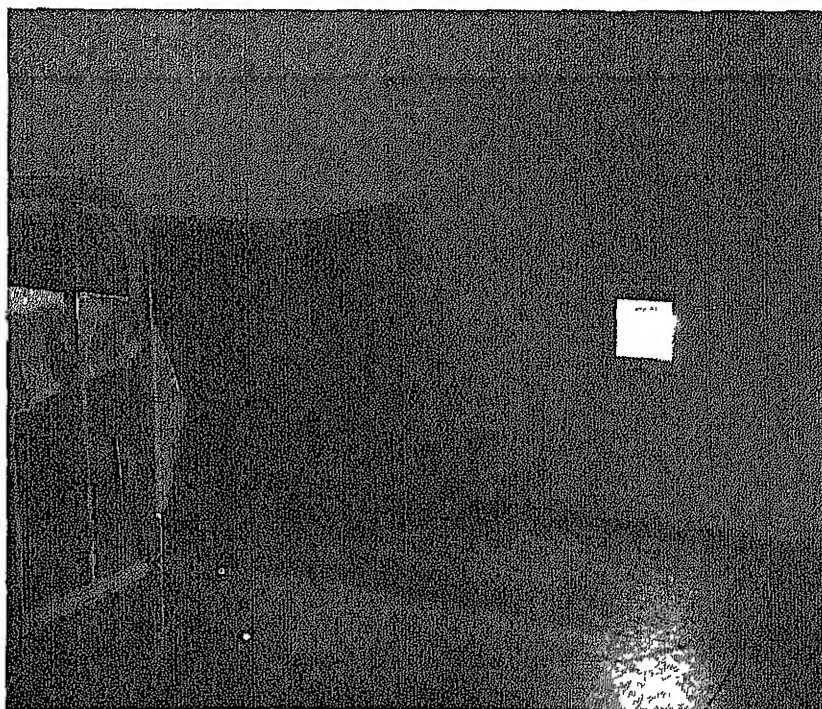
**Brightness:**  
Footlamberts taken one foot from edge of luminaire are indicated by numerals on wall; footlamberts taken on face of luminaire from positions A, B, C at 3 feet 6 inches from floor are shown in table below.

FOOTLAMBERTS on FACE of LUMINAIRE			
Viewing position	A	B	C
Switch on high position	80	50	30
Switch on low position	25	15	10

**Illumination:**  
Lighting levels in footcandle readings on floor as indicated. The maximum illumination with switch in "high" position is 2.5 fc.

**Interior Finishes:**  
Colors and reflectances: Floor—tan, 25 percent; wall on which nightlight is mounted—gray, 50 percent; wall opposite nightlight—gray, 60 percent.

**Remarks:**  
To provide enough light for the nurse entering the room from a lighted corridor, but to minimize interference with the patients' sleep or rest, two levels of nightlighting are recommended. The nightlight illustrated is controlled by a high-low switch. When the switch is in "high" position, lighting levels at the floor are as shown; and when the switch is in the "low" position, these levels and brightnesses are considerably reduced.





**Figure 17. Wall-mounted nightlight, louvered, with stainless steel face finish.**

**Service:**  
Nightlight

**Lamp:**  
One 15-watt incandescent, controlled by a high-low switch

**Brightness:**  
Footlamberts taken one foot from edge of luminaire are indicated by numerals on wall; footlamberts taken on face of luminaire from positions A, B, C at 3 feet 6 inches from floor are shown in table below.

FOOTLAMBERTS on FACE of LUMINAIRE			
Viewing position	A	B	C
Switch on high position	15	10	10
Switch on low position	5	2.5	2.5

**Illumination:**

Lighting levels in footcandle readings on floor as indicated. The maximum illumination with switch in "high" position is 3 fc.

**Interior Finishes:**

Colors and reflectances: Floor—tan, 25 percent; wall on which nightlight is mounted—gray, 50 percent; wall opposite nightlight—gray, 60 percent.

**Remarks:**

To provide enough light for the nurse entering the room from a lighted corridor, but to minimize interference with the patients' rest or sleep, two levels of nightlighting are recommended. The nightlight illustrated is controlled by a high-low switch. When the switch is in "high" position, lighting levels at the floor are as shown; and when the switch is in the "low" position, these levels and brightnesses are considerably reduced.

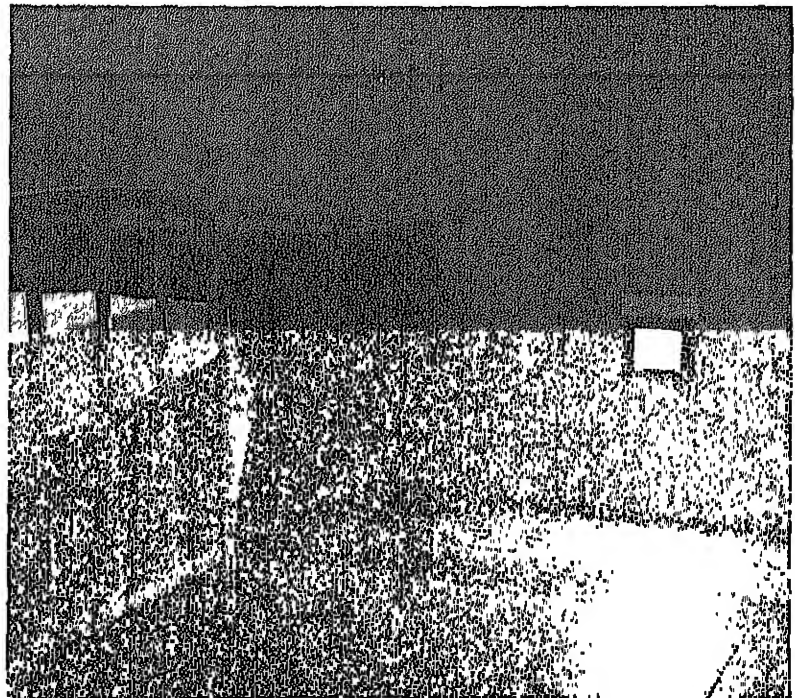
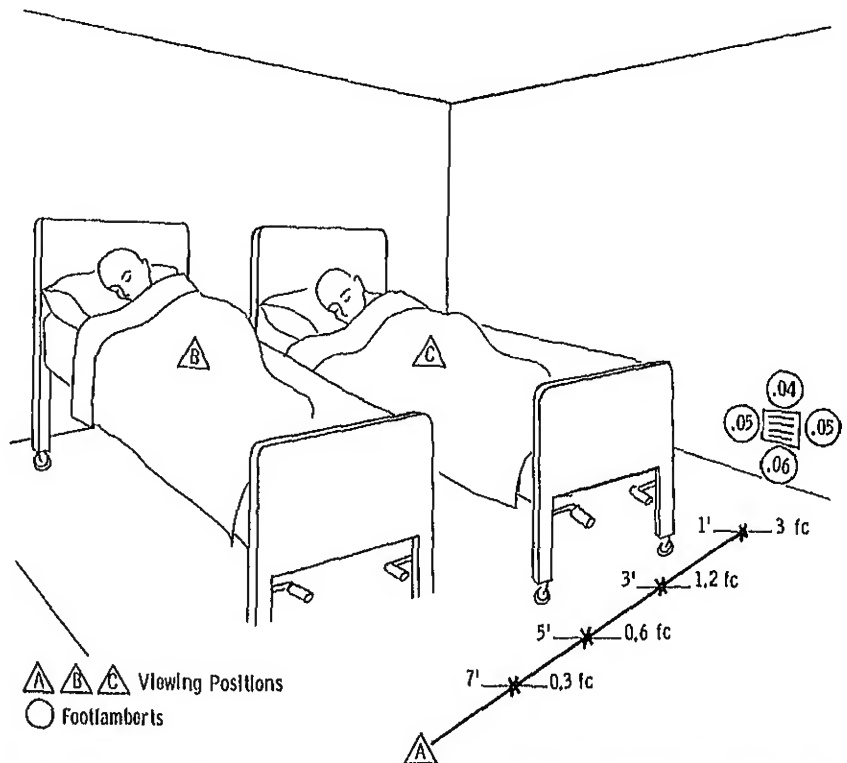
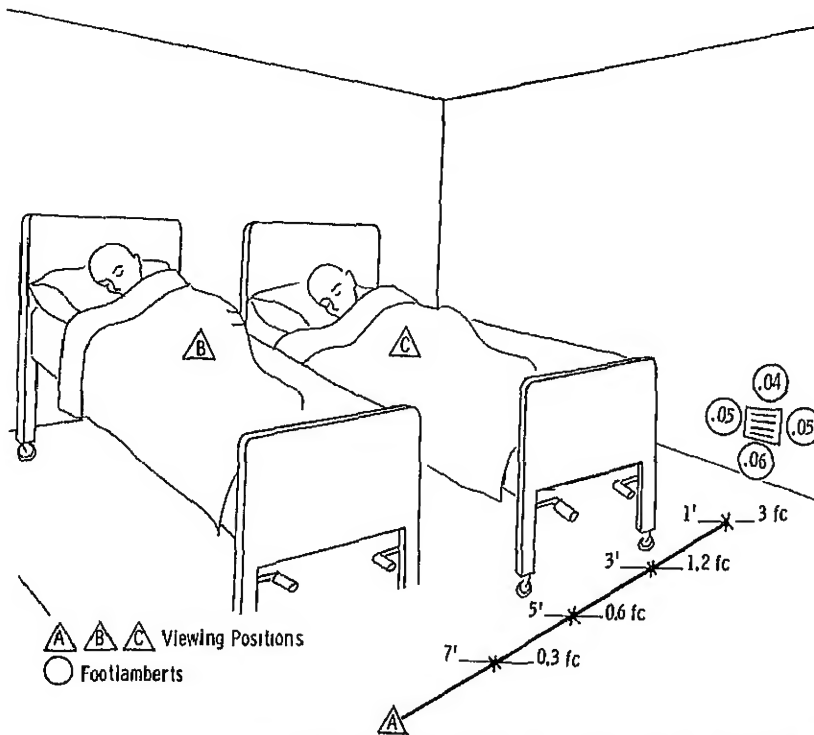


Figure 18. Wall-mounted nightlight, louvered with matte black face finish.



Service:  
Nightlight

Lamp:  
One 15-watt incandescent, controlled by a high-low switch

Brightness:  
Footlamberts taken one foot from edge of luminaire are indicated by numerals on wall; footlamberts taken on face of luminaire from positions A, B, C at 3 feet 6 inches from floor are shown in table below.

FOOTLAMBERTS on FACE of LUMINAIRE

Viewing position	A	B	C
Switch on high position	2	1.5	1.5
Switch on low position	0.6	0.4	0.4

Illumination:

Lighting levels in footcandle readings on floor as indicated. The maximum illumination with switch in "high" position is 3 fc.

Interior Finishes:

Colors and reflectances: Floor—tan, 25 percent; wall on which nightlight is mounted—gray, 50 percent; wall opposite nightlight—gray, 60 percent.

Remarks:

To provide enough light for the nurse entering the room from a lighted corridor, but to minimize interference with patients' rest or sleep, two levels of nightlighting are recommended. The nightlight illustrated is controlled by a high-low switch. When the switch is in "high" position, lighting levels at the floor are as shown; and when the switch is in the "low" position, these levels and brightnesses are considerably reduced.





## Lighting Affected by Surface Finishes

The effects on brightnesses of wall or ceiling finishes that may result from redecorating, or even from fading of colors of original finishes, also should be considered in the design of lighting systems. As an example, a blue wall in one of the mock-up rooms had an original brightness

of 85 footlamberts when lighted with a particular luminaire. After four months this wall had faded enough so that its brightness had increased to 100 footlamberts when lighted with the same luminaire. The data in table 2 give the differences of values for reflectances and brightnesses of ceiling and wall color finishes, as produced by the same light source.

**Table 2.—Reflectance and brightness values (determined for various luminaire types)**

*Table 2a.* Reflectance and brightness values of a specific area on the ceiling, lighted as in figure 5, with 150-watt silver-bowl lamp in ceiling-suspended concentric ring-type luminaire.

Ceiling color	Reflectance (percent)	Brightness (footlamberts)
Blue, dark-----	20	45
Blue, light-----	65	130
Green, medium-----	50	75
Green, light-----	60	110
Red, dark-----	17	60
Yellow-red, medium dark---	37	100
Black, dark-----	6	20
White, light-----	83	170
Gray, light-----	70	140

*Table 2c.* Reflectance and brightness values of a specific area on the wall one foot above luminaire, lighted as in figure 11, with two 40-watt fluorescent (deluxe warm) lamps in a wall bracket with diffusing plastic covers.

Wall color	Reflectance (percent)	Brightness (footlamberts)
Blue, dark-----	20	40
Blue, medium dark-----	40	85
Blue, medium-----	50	100
Blue, light-----	65	120
Green, medium-----	50	70
Green, light-----	60	110
Red, dark-----	17	35
Yellow-red, medium dark---	37	60
Black, dark-----	6	7
White, light-----	83	200

*Table 2b.* Reflectance and brightness values of a specific area on the wall one foot above luminaire, lighted as in figure 9, with 100-watt incandescent lamp in a wall-bracket uplight with translucent plastic shade.

Wall color	Reflectance (percent)	Brightness (footlamberts)
Blue, dark-----	20	75
Blue, medium dark-----	40	110
Blue, medium-----	50	160
Blue, light-----	65	220
Green, medium-----	50	140
Green, light-----	60	180
Red, dark-----	17	90
Watermelon, medium dark red-----	28	130
Yellow-red, medium dark---	37	130
Black, dark-----	6	20
White, light-----	83	320
Gray, light-----	60	210
Gray, medium-----	50	200

*Table 2d.* Reflectance and brightness values of a specific area on the wall one foot above luminaire, lighted as in figure 12, with 100-watt incandescent lamp in a wall-bracket uplight, totally indirect.

Wall color	Reflectance (percent)	Brightness (footlamberts)
Blue, dark-----	20	60
Blue, medium dark-----	40	100
Blue, medium-----	50	150
Blue, light-----	65	200
Green, medium-----	50	120
Green, light-----	60	170
Red, dark-----	17	55
Yellow-red, medium dark---	37	95
Black, dark-----	6	10
White, light-----	83	300

## ADVISORY RECOMMENDATIONS

Discomfort glare produced by excessive brightness is a common and primary source of complaint in patient rooms. Designers should be cognizant of the effects of color and reflectances of interior finishes which contribute to the degree of brightness produced by lighting. Glossy finishes should be avoided.

If fluorescent lamps are used in patient rooms, they should be of the deluxe (warm or cool white) type. Deluxe-type fluorescent lamps are considered satisfactory for use in patient rooms. However, in relamping, the lamps may mistakenly be replaced by any one of a number of color tones other than those for which the system was designed.

### General Lighting

General lighting should be indirect or so designed that the brightness of any luminaire or interior finish does not exceed 90 footlamberts when viewed from any normal bed position.

The general illumination should be produced by one or more luminaires having the capacity to provide a minimum of 10 footcandles 30 inches above the floor, but should not greatly exceed 10 footcandles for normal use. Control equipment is recommended for dimming the illumination to create a soft light for the patient's rest and relaxation.

To prevent excessive spottiness of general lighting in the room, the installation should provide a lighting level ratio of less than 1 to 5 on a horizontal plane 30 inches above the floor within a radial distance of 8 feet from the maximum lighting level on that plane.

### Reading Light

The reading light should be capable of providing about 30 footcandles but not less than 20 footcandles at the normal reading position, assumed to be 3 feet 9 inches above the floor. To allow the patient some freedom to turn in bed without moving out of the reading light zone, the area of the reading plane lighted by an adjustable-type unit should be approximately 3 square feet, and for an adjustable-type unit the area should be approximately 4 square feet. To provide a reasonable degree of uniformity of lighting over these recommended areas, the

lighting level at the outer edge of each area should be not less than two-thirds of the lighting level at the center of the area.

To provide comfortable lighting conditions for reading, the brightness in footlamberts on the ceiling, provided by some means of general lighting, should be at least equal to the illumination in footcandles on the reading matter.

### Observation Light

An observation light should be installed or provided, when needed, for the nurse who must make relatively frequent observations of a patient or of treatment equipment. This luminaire should be positioned to light the bed area and the equipment to about 2 footcandles but not less than 1 footcandle. As this light may be left on all night, if necessary, screens or other means should be provided to shield the light from other patients.

### Examination Light

The examination light should provide not less than 50 footcandles, preferably 100 footcandles or more, and be of a type or so arranged to minimize shadows at the area of interest. To reduce glare and to minimize "spill light" that may affect others in the room, this light should be shielded or adjusted to confine it to the bed area of the patient being examined or treated.

Nonadjustable examination lights should light the bed area to a degree of evenness so that the lighting level does not vary more than 2 to 1 over the entire bed area.

Adjustable examination lights should be capable of producing the recommended lighting levels in the center of a circular area 2 feet in diameter, at a distance of not less than 2 feet from the light source enclosure, and at least half the level at the outer edge.

Portable examination lights should be capable of lighting performance similar to that described above for adjustable units.

Because the illumination requirements for examinations and nursing service vary over a wide range, arrangements for dimming the lights might be considered. However, since an examination light is ordinarily used infrequently and for relatively short periods, the added

cost of providing dimming controls is generally not justifiable.

The light level and effective color of the examination light should be adequate to permit rapid and correct evaluation of the patient's condition as judged from color or condition of the patient's skin or tissue. It is generally agreed that the color and quality of daylight, under specific conditions, are superior to that of electric light for most color classification tasks. Daylight itself is variable, often not available, and electric lighting of this color and quality (the order of 6500° K) appears quite blue unless the viewer's eyes are adapted to this light alone after individually variable periods of work under it. Consequently, daylight color and quality of electric lighting (6500° K) is not a justifiable requirement for patient rooms. In most cases, satisfactory lighting can be provided for examination of patients in bedrooms by use of commercially available incandescent filament lamps and deluxe-type fluorescent lamps that are within the color temperature range of 2950° K to 4500° K. Daylight incandescent filament lamps (approximately 4000° K) and deluxe cool-white fluorescent lamps (approximately 4200° K) fall within this range. Also, the recommended color may be obtained by use of fixed examination lights aided by other lamps and commercially available filters.

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## Nightlight

*Nightlights* are needed to provide only a low level of illumination; therefore, the brightness of the luminaire and its immediate surroundings should be low enough in brightness-contrast to minimize discomfort to the patients. Accordingly, it was found that the brightness of the nightlight luminaire should not exceed 20 footlamberts. However, if this brightness provides insufficient illumination for the nurse, a brightness up to 60 footlamberts and correspondingly higher footcandles may be tolerated by the patient for momentary use. Brightnesses in this range may be provided by a suitable control switch, such as a rectifier-type dimming switch mounted at the door, convenient for the nurse to switch to the higher lighting level as she enters the room and back to the lower level as she leaves the room.

Nightlights that utilize louvers through which the light is emitted should be so constructed or so installed that there will be no direct view of the light source from a normal in-bed position. The surface finish of the nightlight should be such as to have a very low brightness value at all times.



## **APPENDIXES**

**Appendix A. Medical and Related Needs for Lighting in a Patient Room in a General Hospital**

**Appendix B. Selected Bibliography**

# Appendix A

## MEDICAL AND RELATED NEEDS FOR LIGHTING IN A PATIENT ROOM IN A GENERAL HOSPITAL

by

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This study emphasizes lighting requisites primarily from the viewpoint of the clinical needs and care of the patient and includes the activities of those persons involved in rendering service to or for the patient in the patient's room. The following analysis is a summary of the various conditions for which light is needed in the patient's room. It includes a comprehensive listing of the activities frequently or occasionally performed in a patient room, including those of patient, physician, nurse, technicians, maintenance people, and visitors.

The information is summarized under four categories, as follows:

<i>Section No.</i>	<i>Category</i>
I	General factors
II	Kinds of light needed
III	People needing light
IV	Activities for which light is needed

### SECTION I. GENERAL FACTORS

Of all the lighting systems used in a general hospital, probably those provided in the patient rooms have created the most concern. As far as we can determine, no known lighting systems are entirely satisfactory for these areas. Systems designed to triple or quadruple lighting levels often defeat their basic purpose, introduce glare, lead to complaints, and may lower human efficiency.

Formerly, light selection and design apparently were based on such notions as good taste, personal feelings, or the application of rules to establish definite levels of foot-candles. For present and future needs, the designing and selection of light for ideal light balance should be considered for brightness and color control in the environment, as well as for other specific factors.

The many current developments in clinical and administrative practices, summarized below, are significant, and indicate the quantity and quality of lighting needed.

#### A. *Changes in clinical practices*

1. *Early ambulation:* More patients are up and moving about in their rooms during the major period of their hospitalization, whereas formerly most patients were kept in bed until a day or two prior to their discharge from the hospital.

2. *Patient self-care:* Combined with the practice of early ambulation, patients are encouraged to be active during their hospitalization. As a result, patients now attend to more aspects of personal care.

3. *Implementation of new diagnostic procedures and the availability of mobile equipment:* Many services and procedures, such as blood chemistry, basal metabolism, electrocardiography, and X-rays, now are being performed in patient rooms instead of transporting the patient to the laboratory or other diagnostic areas.

4. *Use of new drugs:* The administration of many new drugs requires frequent dosage and the use of hypodermic needles, thus increasing the need for light in order to find the site of injection and to observe patient reaction.

#### B. *Changes in administrative practices*

1. *Varied personnel:* Employment of many kinds of personnel such as aides and special therapists and greater use of part-time workers and volunteers for various tasks.

2. *Visitors and patients:* More lenient visiting hours and less restriction of visitors for patients have increased significantly the general flow of numerous persons to

patient rooms. Also, as a result of the practice of early ambulation, more patients visit each other's rooms or continue their business functions either with visiting associates or via telephone.

3. *Safety precaution:* As a corollary to public education regarding accident prevention, hospitals have implemented safety programs, including increased use of light, which help to avoid litigation.

### C. Other factors

1. Aging population and increased age of retirement indicate an increase in the percentage of older patients, nurses, and other personnel rendering service; the decrease in their visual acuity must be considered.

2. Availability of greater quantities of reading matter for patients.

3. Trend for hospitals to use more printed materials to inform and instruct patients.

4. Use of color in lighting to enhance the appearance of the area and to create a psychologically pleasing environment.

## SECTION II. LIGHTING SERVICES

The lighting services needed generally are classified as:

General illumination	Examination light
Reading light	Nightlight

Special lighting features occasionally are needed for patients. For example, for patients following ocular surgery, provision should be made to attain a low lighting level, devoid of high brightness or glare. Some patients require special reading devices, such as projector light for patients on Stryker frames. Reading lights should be provided for bedpatients and for patients in chairs.

Local lighting or special-use lighting may be needed for certain types of equipment or for observation.

## SECTION III. PEOPLE NEEDING LIGHT

In addition to the patient, there are a variety of individuals needing light in the patient's room. The following list indicates the range of persons who visit this area:

Physicians (including surgeons, anesthesiologists, dentists)	Technicians (X-ray laboratory)
Nurses	Housekeeping personnel
Dietitians	Maintenance personnel
Therapists	Administrative personnel
Social workers	Visitors

## SECTION IV. ACTIVITIES REQUIRING LIGHT

The diversity of the people who have reason to be in the patient's room makes it pertinent to examine some of their specific activities in order to analyze the extent of lighting that may be required. The activities of the patient, the physician, and the nurse are enumerated below; within each group a few examples are given to illustrate some of the details involved.

### A. Patients

#### 1. *Self-care:*

Getting out of bed; attending to personal hygiene and grooming; obtaining and using articles on bedside table; locating and selecting clothing which involves looking for items in dresser drawers or closets; dressing.

#### 2. *Use of equipment:*

Reading projectors, telephone, radio, television.

#### 3. *Visitors:*

Personal, business, stenographic, clerical.

#### 4. *Social activities:*

Playing cards; visiting and conversing with other patients.

*. Location:*  
Signal lights, doorways, toilet rooms, lavatories, bedside table.

*. Disposal of contaminated articles:*  
Handkerchiefs.

*Walking in room:*  
Avoiding possibility of stumbling over objects such as rugs, chairs, and other furnishings.

*Other activities:*  
Eating, smoking, reading, writing, needlework.

## *. Physicians*

### *1. Medical rounds:*

- a. General observation or examination of patient
- b. Specific physical examination of patient
- c. Write or read medical orders
- d. Instruct nurse or patient
- e. Gown and wash hands prior to treating patient, performing procedure, or to care for isolated patient
- f. Treat specific body parts

### *2. Medical history:*

- a. Read identification materials (name tag on bed, admission data on chart, history of former hospitalized periods, reports or data from referral agency or physician)
- b. Interview, converse with, and observe patient behavior, reactions, and physical appearance
- c. Write notations on medical record

### *3. Consultation:*

- a. Read patient's identification and medical record data
- b. Observe patient, examine, or treat specific body parts
- c. Converse with other physicians and with patient
- d. Position or arrange patient for examination or treatment
- e. Arrange and use instruments and medicinal agents (involves reading fine graduations on syringes or closely observing amount of agent drawn)
- f. Observe patient's response to medication or treatment

- g. Check drainage and adjust treatment apparatus
- h. Look at X-rays
- i. Write notations on medical record

### *4. Procedures:*

- a. Measurement of blood pressure (read and record measurement, remove and return equipment to container)
- b. Obtain specimens for diagnostic tests
- c. Perform gavage, lavage, paracentesis
- d. Apply, remove, or adjust casts, splints, and other orthopedic appliances or dressings

## *C. Nurses*

### *1. General care:*

- a. Admit and receive new patient
- b. Prepare patient bed unit
- c. Prepare patient (undress, dress, arrange for safekeeping of personal belongings)
- d. Assist or administer personal care (bathe, shampoo, comb hair, direct oral hygiene)
- e. Help patient into or out of bed or chair
- f. Give or remove bedpan or urinal
- g. Prepare patient for meals and nourishments; assist, serve, or feed patient
- h. Visit and/or observe patient for needs
- i. Inspect patient rooms (tiny bedside tables, dressers, other furnishings; remove soiled linen and articles to be discarded)
- j. Check equipment and apparatus

### *2. Administration of medicine:*

- a. Read patient's identification
- b. Select right medication from carts or trays for administration to patient
- c. Give or assist patient receiving medication (orally, hypodermically, application)
- d. Record notes (medication given, patient's response)

### *3. Observations and data recording:*

- a. Note progress of patient (skin color, restlessness, respiratory functioning, reaction to medications and treatments; if obstetrical patient, note contractions and other symptoms)



- b. Observe fluid intake, color and quantity of urine, vomitus, or feces
4. *Assist physician(s) during examinations, procedures, or treatments:*
  - a. General or specific examination (eyes, ears, vaginal, proctoscopic)
  - b. Procedures such as aspiration, gavage, lavage, vena puncture, lumbar puncture, abdominal paracentesis
  - c. Apply, remove, or adjust appliances and equipment (casts, splints, and other orthopedic appliances; bandages, restraints)
5. *Other phases of nursing care, specific treatment, procedures, or assistance:*
  - a. Take temperature (oral, axilla, rectal), pulse, and respiration:
    - 1) Identify patient; inspect thermometer to detect imperfections or broken tips
    - 2) Insert or place thermometer; observe patient's condition; observe watch and patient to obtain accurate pulse and respiration rates; read fine graduations on thermometer
    - 3) Clean thermometer; record observations on chart
  - b. Prepare patient for catheterization and/or bladder irrigation:
    - 1) Identify patient; arrange tray and other articles; prepare and drape patient; cleanse and prepare specific site area
    - 2) Manipulate catheter and equipment for withdrawal of urine; introduce solution; observe flow of urine for collecting in receptacle; check amount of solution introduced and return flow
    - 3) Handle and manage safely the removal of receptacle and equipment from bed; reassemble equipment on tray
    - 4) Care of patient and bed after treatment
    - 5) Prepare specimen for laboratory (transfer urine to container, label specimen)
    - 6) Record treatment and data on medical chart or forms
  - 7) Transport (carry or by other means) equipment tray and articles from patient's room, avoiding stumbling or tripping over furniture
  - c. Care during specific situations:
    - 1) Prepare bed unit for return of patient from operating room, recovery room, delivery room, treatment areas, X-ray
    - 2) Presurgery; post-anesthesia; shock recovery; tracheotomy; if obstetrical patient, prepare for delivery and after delivery
    - 3) Observe equipment and apparatus (heat cradles, oxygen tent or respirator, orthopedic appliances)
    - 4) Apply compresses, surgical dressings, binders, ice collars, electric pads
    - 5) Assist or instruct patient in walking with or without orthopedic appliances
    - 6) Care during transfer from bed to stretcher or during early ambulation
    - 7) Bathe, dress, feed infants or children
    - 8) Orient and instruct patient prior to treatment
    - 9) Instruct others of specific nursing procedures or general care
    - 10) Arrange for removal of deceased patients
  - d. Assist, start, check, or terminate procedures and treatment:
    - 1) Postural drainage; tidal drainage
    - 2) Hypodermoclysis; intravenous solutions
    - 3) Wangenstein suction; Levine tube
    - 4) Aerosol therapy; oxygen or steam inhalation
    - 5) Diathermy; light treatment
    - 6) Therapeutic bed baths; immersion of body, or arm or foot soaks
    - 7) Enemas; perineal care
    - 8) Installations and irrigations of ear, eye, throat, colostomy

## Appendix B

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